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02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics. **1852**

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Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems. **1857**

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Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation. **1886**

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Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories. **1891**

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Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control; reliability; drafting; and materials fabrication, handling, and inspection. **1924**

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18 MATERIALS, NONMETALLIC
Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics. **1941**

19 MATHEMATICS
Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers. **1947**

20 METEOROLOGY
Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences. 1951

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Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications. 1959

22 NUCLEAR ENGINEERING
Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related Information see also: 03 Auxiliary Systems; and 28 Propulsion Systems. 1961

23 PHYSICS, GENERAL
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31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics. **2000**

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic. **2003**

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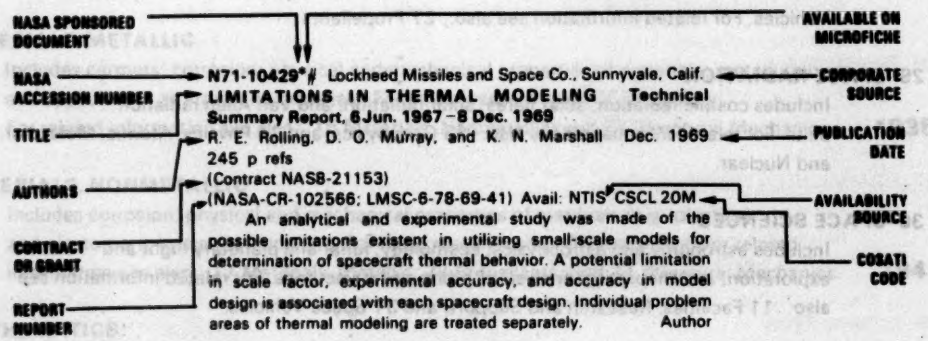
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An analytical and experimental study was made of the possible limitations existent in utilizing small-scale models for determination of spacecraft thermal behavior. A potential limitation in scale factor, experimental accuracy, and accuracy in model design is associated with each spacecraft design. Individual problem areas of thermal modeling are treated separately. Author
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VOLUME 9 NUMBER 12 / JUNE 23, 1971

Scientific and Technical Aerospace Reports

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Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N71-23125*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

WIND-TUNNEL INVESTIGATION OF SONIC-BOOM CHARACTERISTICS OF TWO SIMPLE WING MODELS AT MACH NUMBERS FROM 2.3 TO 4.63

David S. Miller, Odell A. Morris, and Harry W. Carlson Washington Apr. 1971 31 p refs

(NASA-TN-D-6201; L-7178) Avail: NTIS CSCL 01A

A wind tunnel investigation was undertaken to provide experimental data for use in studying lift-induced sonic boom characteristics at high supersonic Mach numbers. Pressure signatures below two simple wing models were measured at two separation distances for a range of lift coefficients at Mach numbers of 2.3, 2.96, 3.83 and 4.63. Comparisons of theoretical and experimental pressure signatures showed that the good agreement obtained for the lowest Mach number of this investigation does not persist into the higher Mach number range, particularly for high lift coefficients. In all instances, the overall signature correlation became worse with increasing Mach number and with increasing lift coefficient. Impulse comparisons indicated that even at extremely large distances experimental and theoretical overpressures could differ by as much as 20 percent. Author

N71-23126*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

FORTRAN PROGRAM FOR QUASI-THREE-DIMENSIONAL CALCULATION OF SURFACE VELOCITIES AND CHOKING FLOW FOR TURBOMACHINE BLADE ROWS

Theodore Katsanis Washington Apr. 1971 37 p refs

(NASA-TN-D-6177; E-5869) Avail: NTIS CSCL 20D

A quasi-three dimensional compressible flow analysis for axial flow turbines, was generalized to allow for mixed or radial flow and for nonuniform inlet conditions. The velocity gradient method is used, with one velocity gradient equation used for radial equilibrium and another velocity gradient equation for blade-to-blade variation. Author

N71-23131+ National Aerospace Lab., Amsterdam (Netherlands).

APPLICATION OF A METHOD FOR ESTIMATING PRESSURE DISTRIBUTIONS TO AN OSCILLATING T-TAIL

R. J. Zwaan 1 May 1968 55 p refs

(NLR-TR-68048-L) Avail: NTIS

A method proposed to estimate pressure distributions from theory and from measured distributions for one vibration mode, was applied to a T tail configuration at low speeds. The results indicate that the method may be used successfully. Author

N71-23132*# General Motors Corp., Indianapolis, Ind.

DESIGN AND EXPERIMENTAL RESULTS OF A HIGHLY LOADED, LOW SOLIDITY TANDEM ROTOR

James L. Bettner Washington NASA Apr. 1971 68 p refs

(Contract NAS3-11164)

(NASA-CR-1803; EDR-6627) Avail: NTIS CSCL 01A

The overall performance of a single stage turbine with a low solidity tandem rotor blade assembly was tested over a range of equivalent speeds and expansion ratios. The rotor blades were designed with negative hub reaction and a mean line axial chord solidity of 1.092. The results of this investigation are compared with the performance of a modified tandem rotor blade which was designed to similar velocity diagrams but with a mean section axial chord solidity of 1.852. Both rotors were tested with the same stator. Author

N71-23133*# Nielsen Engineering and Research, Inc., Mountain View, Calif.

CALCULATIVE TECHNIQUES FOR TRANSONIC FLOWS ABOUT CERTAIN CLASSES OF AIRFOILS AND SLENDER BODIES

J. R. Spreiter and S. S. Stahara Washington NASA Apr. 1971 144 p refs

(Contract NAS2-5410)

(NASA-CR-1722) Avail: NTIS CSCL 01A

Procedures based on the method of local linearization and transonic equivalence rule were developed for predicting properties of transonic flows about thin airfoils and slender bodies. The procedures are applicable to transonic flows with free stream Mach numbers near one, below the lower critical, and above the upper critical. Comparisons with experimental surface pressure distributions exhibit good agreement for all shapes considered, although discrepancies appear near the aft region, particularly for the slender bodies. Analysis of the discrepancies suggests substantial wind tunnel wall interference effects are present in the experimental results for the three dimensional shapes. Effects of shock wave boundary layer interaction and vortex induced separation are not included in the theory. Author

N71-23134*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

LOW-SPEED JET NOISE FROM A 1.83 METER (6FT) FAN FOR TURBOFAN ENGINES

Gene L. Minner and Charles E. Feiler Washington Apr. 1971 16 p refs

(NASA-TN-D-6314; E-6124) Avail: NTIS CSCL 20D

The jet noise from a large fan model was determined for two simulated nacelle configurations. These were a hard wall nacelle and one having acoustic liners on the walls and on inlet splitter rings. The jet velocity range of the data was from 137 to 223 meters per second (450 to 730 ft/sec). The data show that internally generated low frequency noise is effectively removed by the acoustic liners. Data from the lined configurations show the classical eighth power dependence on jet velocity. Data from the hard wall configurations were higher in (NASA-TM-X-67809) and had a weaker velocity dependence due to the noise from internal sources. Several comparisons of the data were made with correlations of jet noise data from the literature. Author

N71-23135*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

LOW-SUBSONIC LONGITUDINAL AERODYNAMIC CHARACTERISTICS OF A TWIN-BODY SPACE-SHUTTLE BOOSTER CONFIGURATION

Bernard Spencer, Jr. and George M. Ware Washington Apr. 1971 60 p

(NASA-TM-X-2162; L-7417) Avail: NTIS CSCL 01A

An investigation was conducted in the low turbulence pressure tunnel with a model representative of a first stage booster space shuttle concept proposed by industry. The configuration consisted of twin body elements connected by fore and aft wings with each body having an outboard horizontal and a vertical stabilizer. The tests were made at angles of attack from about −4 deg to 20 deg at 0 deg sideslip. Tests were made over a range of Reynolds numbers (based on body length) from 4.34 million to 26 million at Mach numbers below 0.35. Author

N71-23210# Advisory Group for Aerospace Research and Development, Paris (France).

FREQUENCY RESPONSE FUNCTIONS AND HUMAN PILOT MODELLING

Mar. 1971 65 p refs Mostly in ENGLISH; partly in FRENCH

(AGARD-R-580-71) Avail: NTIS

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3. TRANSFER FUNCTION OF FLEXIBLE AIRCRAFT TO AMOSPHERIC TURBULENCE G. Coupry (ONERA, Paris, France) p 45−58 refs (See N71-23213 12-02)

4. HUMAN PILOT MODELLING H. F. Huddleston (RAE, Farnborough, Engl. p 59−65 refs (See N71-23214 12-04)

N71-23211# Aeronautical Research Associates of Princeton, Inc., N.J.

THE ART OF DETERMINING GUST FREQUENCY RESPONSE FUNCTION

John C. Houbolt *In* AGARD Freq. Response Functions and Human Pilot Modelling Mar. 1971 p 1−20 refs (See N71-23210 12-01)

Avail: NTIS

The art of determining the frequency response function for gust response, and of deriving the associated structural response parameters A and N sub o is discussed. Measured and computed values are compared to show the degree of success obtained. It is brought out that frequency response determination is a computationally large task and that simplified procedures are needed. Emphasis is also given to the fact that there is not a frequency response function for the airplane, but that there are many, depending on flight conditions. A procedure is suggested for helping to establish the appropriate frequency response functions, and the A and N sub o values, for use in design. Author

N71-23278*# Scientific Translation Service, Santa Barbara, Calif.

ACCELERATED SUPERSONIC MOTION OF A PLANE AT A FINITE ANGLE OF ATTACK [USKORENNOYE SVERKHZVUKOVYE DVIZHENIYE PLASTINY PRI KONECHNOM UGLE ATAKI]

O. G. Goman Washington NASA Apr. 1971 12 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza (Moscow), no. 4, Jul.−Aug. 1970 p 70−75

(Contract NASw-2035)

(NASA-TT-F-13525) Avail: NTIS CSCL 01A

Supersonic nonsteady motion of a plane in an ideal gas is considered. The plane with the attached shock wave moves at a finite (not infinitely small) angle of attack. The laws governing the change of velocity and the angle of inclination of the plane are assumed to be arbitrary, and the Struhal numbers are small. With the latter assumption, and with Mach numbers in the perturbed area not too close to unity, the motion can be characterized sufficiently well by instantaneous values of the nonsteady parameters and their derivatives. This fact provides the possibility of simplifying considerably the system of equations describing the perturbed nonsteady movement, and to obtain its analytical solution. Author

N71-23283# ITT Research Inst., Chicago, Ill.

PRELIMINARY STUDY OF AN AUGMENTED RAM-WING VEHICLE CONCEPT Final Report, 1 Aug. 1967−18 May 1968

Imants Reba Jan. 1971 126 p refs

(Contract DOT-7-33512)

(PB-189425; IITRI-J6128-FR) Avail: NTIS CSCL 13F

A wind-tunnel study of a ram-wing-type vehicle with various blowing arrangements is reported. Two models were studied. One model represented a thick vehicle configuration with a blunted rear end. The second had a streamlined chord section. Blowing arrangements consisted of two two-dimensional Coanda nozzles, one placed near the leading edge and one near the midchord. Upward, downward, and mixed blowing arrangements were investigated. The results indicate that the downward blowing near the leading edge and upward blowing at midspan constitute the most promising of those arrangements investigated. Author (GRA)

N71-23422# Ecole Nationale Superieure de l'Aeronautique, Toulouse (France).

INFLUENCE OF SIMPLE AERODYNAMIC MODIFICATIONS ON THE PERFORMANCE OF AN AIRCRAFT [INFLUENCE DE MODIFICATIONS AERODYNAMIQUES SIMPLES SUR LE COMPORTEMENT D'UN AVION]

J. E. Forestier *In* AGARD Lessons with Emphasis on Flight Mech. from Operating Experience Incidents and Accidents Mar. 1971 12 p (See N71-23410 12-02)

Avail: NTIS HC $6.00/MF $0.95

Described are modifications made on prototype Vautour aircrafts during their development phase. Principle difficulties encountered were lateral control and beyond Mach 0.93 longitudinal control characteristics. Adjustments of the turbulence generator positions on the outer airfoils just before the wing tip, and modifications in the chamber of the wing leading edge provided the desired performance improvements. Transl. by G.G.

N71-23475# Lockheed-Georgia Co., Marietta.

A THEORETICAL INVESTIGATION OF A CIRCULAR LIFTING JET IN A CROSS FLOWING MAINSTREAM Final Report, Jul. 1969−Dec. 1970

James E. Hackett and H. Ronald Miller Wright-Patterson AFB, Ohio AFFDL Jan. 1971 59 p refs

(Contract F33615-69-C-1753)

(AD-718121; LGR-ER-10940; AFFDL-TR-70-170) Avail: NTIS CSCL 1/1

Finite-element potential-flow-modeling theoretical techniques are described which predict, from first principles, both the rolled-up geometry and the path of a round lifting jet convergent into a

cross-flowing mainstream, as on VTOL or direct lift-assisted STOL aircraft. Starting with a straight-cylinder geometry, point vortex elements are perturbed using a pre dictor-corrector stepping method to give a first estimate of the bent-back shape, using assumed circulation values. A collocation scheme is next used to revise the circulation values, and after three or four iterations, a final exit-plane pressure distribution may be calculated. The fan-induced total pressure rise is simulated by injecting vortex rings at a chosen position in th duct which feeds the jet. Since the scope of the method is entirely non-viscous, separations toward the rear of real jets and the associated pressure changes are not simulated and base-pressure type of pressures cannot be expected. Nevertheless, for forward speed ratios of 0.1, 0.2, 0.3 and 0.4, the low-pressure contours at each side of the jet do show an increasing rearward shift, just as is found experimentally. Somewhat surprisingly, the simulated plumes were more stable at higher velocity ratios. At lower forward speeds, there was a tendency to flap, rather like a hose end when freed. It is anticipated that, if viscous effects were simulated, these motions might damp out. Author (GRA)

N71-23497* National Aeronautics and Space Adminstration. Langley Research Center, Langley Station, Va.

LEADING EDGE CURVATURE BASED ON CONVECTIVE HEATING Patent

Dewey E. Wornom, inventor (to NASA) Issued 16 Jul. 1968 (Filed 1 Sep. 1965) 5 p Cl. 244-13

(NASA-Case-XLA-01486; US-Patent-3,392,936; US-Patent-Appl-SN-484485) Avail: US Patent Office CSCL 01A

A high speed flight vehicle having improved flight efficiently at both subsonic and high speeds is described. All leading edges of the vehicle are provided with leading edge curvature while the leading edge sweep is maintained, along with a corresponding decreasing leading edge radius, such that the relationship between sweep and radius that is normally associated with aerodynamic heating at high speeds is not altered.

Official Gazette of the U.S. Patent Office

N71-23597# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Hauptabteilung Wissenschaft und Technik.

NUMERICAL METHOD FOR EVALUATING AERODYNAMIC COEFFICIENTS OF THIN SUPERSONIC WINGS AT ANGLE-OF-ATTACK CONDITIONS [NUMERISCHES VERFAHREN ZUR BESTIMMUNG ANSTELLWINKELABHAENGIGER AERODYNAMISCHER BEIWERTE DUENNER UEBERSCHALLFLUEGEL]

Walter Helmut Diesinger Jan. 1971 68 p refs In GERMAN; ENGLISH summary

(DLR-FB-71-01) Avail: NTIS; ZLDI Munich: 17.50 DM

The numerical method makes use of the linearized potential flow theory and is limited to wings where Evvard's theorem can be applied. The method fits especially to preliminary design calculations where influence of warping and thickness of the wing are not needed. The aerodynamic coefficients are evaluated by numerical integration of the velocity potential for which the numerical accuracy can be determined by a simple additional procedure. Because of the comparatively small amount of calculations the method may be applied to reduce the running time of existing computer programs. For the application at desk calculation machines tables are listed and simple examples presented. Author (ESRO)

N71-23859*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

OVERALL PERFORMANCE IN ARGON OF A 16.4 CENTIMETER (6.44 INCH) SWEPT BACK BLADED CENTRIFUGAL COMPRESSOR

Carl Weigel, Calvin L. Ball, and Edward R. Tysl Washington Apr. 1971 21 p refs

(NASA-TM-X-2269; E-6100) Avail: NTIS CSCL 20D

Overall compressor performance is presented as a function equivalent weight flow. At the design equivalent weight flow of 0.69 kg/sec (1.52 lb/sec) and the design equivalent tip speed of 325 m/sec (1066 ft/sec), the compressor produced an overall total pressure ratio of 2.26 and an adiabatic efficiency of 0.80. The peak efficiency at design speed was 0.808 at an equivalent weight flow of 0.65 kg/sec (1.43 lbm/sec). Author

N71-23860# Martin Marietta Corp., Baltimore, Md. Research Inst. for Advanced Studies.

SPAN LOADING AND WAKE FORMATION

Peter F. Jordan Dec. 1970 27 p refs Presented at AF-OSR-Boeing Symp. on Aircraft Wake Turbulence, Seattle, 1–3 Sep. 1970

(Contract F44620-69-C-0096)

(AD-718024; RIAS-TR-70-12C; AFOSR-70-2873-TR) Avail: NTIS CSCL 1/1

Contrary to the classical assumption of an elliptic span loading, the actual span loading contains a logarithmic term. In consequence, there is an infinite upwash directly behind the wing just inside the wing tip. This explains why the aircraft wake rolls up faster than classical analyses predict. The downwash distribution behind the circular wing is calculated in some detail. Author (GRA)

N71-23778# Aeronautical Research Labs., Melbourne (Australia).

STATIC PRESSURE PROBES AT MACH 7.5

M. J. Williams Sep. 1970 15 p refs

(ARL/A-327) Avail: NTIS

Two static pressure probe shapes with pressure holes at varying distance from the nose have been tested at Mach number 1.5 in the Reynolds number range from 3200 to 9600, based on probe diameter. Self-induced pressures produced by boundary layer interaction with the external inviscid flow were strongly dependent on hole position and could not be correlated by the flat plate viscous interaction parameter. The influence of nose shape was negligible at stations not too close to the shoulder, as was the effect of probe temperature. As a result of these tests design and calibration data for probes suitable for detailed exploration of the core of the tunnel flow are now available. Author

N71-23779*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

MEASUREMENTS OF BOUNDARY LAYER TRANSITION, SEPARATION AND STREAMLINE DIRECTION ON ROTATING BLADES

William J. McCroskey Washington Apr. 1971 38 p refs Prepared in cooperation with Army Air Mobility Res. and Develop. Lab; Moffett Field, Calif.

(NASA-TN-D-6321; A-3863) Avail: NTIS CSCL 20D

Laminar separation, transition to turbulence, and surface streamline directions were measured on helicopter rotor blades in a variety of rotating and nonrotating configurations. The results indicate that the centrifugal effects of rotation do not significantly alter the boundary layer development for most operating conditions. Laminar separation bubbles were observed near the leading edge of the upper surface of the blades at moderate and large angles of attack, and this phenomenon triggered a sudden transition to turbulent flow. Surface streamline patterns were found to be the same for both laminar and turbulent flows. Author

N71-23861*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

LARGE-SCALE WIND TUNNEL INVESTIGATION OF A DUCTED FAN: DEFLECTED-SLIPSTREAM MODEL WITH AN AUXILIARY WING

Michael D. Falarski and Kennety W. Mort Washington Apr. 1971 49 p refs Prepared in cooperation with Army Air Mobility R and D Lab.

(NASA-TN-D-6323; A-3670) Avail: NTIS CSCL 20D

The longitudinal aerodynamic characteristics of a semispan wing deflected-slipstream configuration with a double-slotted flap and an auxiliary wing were determined. The model was powered by two low-pressure-ratio ducted fans. A comparison of static test results with results obtained from various propeller-driven configurations indicates that the turning effectiveness of fan-powered deflected-slipstream configurations can be correlated with propeller-powered configurations with the same flap-chord to slipstream-diameter ratio. The turning effectiveness of the auxiliary wing was essentially the same as would be produced by a conventional slotted flap system with the same flap-chord to slipstream-diameter ration. The auxiliary wing reduced the thrust required at low speeds as would be expected due to the increase in lifting surface area. Author

N71-23931# Aeronautical Research Labs., Melbourne (Australia).
DEPARTMENT OF SUPPLY, AERONAUTICAL RESEARCH LABORATORIES ANNUAL REPORT, 1969 – 1970
Canberra, Australia Australian Govt. Publishing Serv. 1971 92 p refs Original Contains Color Illustrations
Avail: NTIS

Summaries for the research during this period are presented. Topics include: wind tunnel facilities, aerodynamics, structural analysis, atmospheric turbulence, and instrumentation. F.O.S.

N71-24001*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SURFACE-FLOW VISUALIZATION PHOTOGRAPHS OF THE MSC ORBITER AND A 55 DEG SWEPT DELTA WING MODIFICATION FOR SEVERAL REYNOLDS NUMBERS AT MACH NO. 10.4
H. Lee Seegmiller Apr. 1970 110 p refs
(NASA-TM-X-62033) Avail: NTIS CSCL 20D

Surface flow visualization photographs are presented for the straight wing orbiter concept. Results are also shown for a 55 deg swept delta wing modification to the configuration and for the fuselage without wings. The surface flow streamlines were visualized with an oil flow technique at a Mach number of 10.4 and length Reynolds numbers of 0.5, 0.84, and 2.7×1 million. The angles of attack were 18 deg, 40 deg, 50 deg, 60 deg, and 70 deg. Author

N71-24172*+ National Aeronautics and Space Administration, Washington, D.C.
AERONAUTICAL ENGINEERING: A SPECIAL BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 1)
Jan. 1971 556 p refs
(NASA-SP-7037(01)) Avail: NTIS HC$6.00/MF$0.95 CSCL 01A

This supplement to Aeronautical Engineering – A Special Bibliography (NASA SP-7037) lists 1988 reports, journal articles, and other documents originally announced between September and December 1970 in Scientific and Technical Aerospace Reports (STAR) or in International Aerospace Abstracts (IAA). NASA SP-7037 covered documents announced in STAR or IAA during the period, January – August 1970. The coverage includes documents on the engineering and theoretical aspects of design, construction, evaluation, testing, operation, and performance of aircraft (including aircraft engines) and associated components, equipment, and systems. It also includes research and development in aerodynamics, aeronautics, and ground support equipment for aeronautical vehicles. Author

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc.; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N71-23124*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECT OF ENGINE POSITION AND HIGH-LIFT DEVICES ON AERODYNAMIC CHARACTERISTICS OF AN EXTERNAL-FLOW JET-FLAP STOL MODEL
Charles C. Smith, Jr. Washington Mar. 1971 141 p refs
(NASA-TN-D-6222; L-7581) Avail: NTIS CSCL 01C

An investigation was conducted to provide some basic information on the aerodynamic design parameters of an external flow, jet flap configuration. Static force tests were included to determine the effects of engine vertical and longitudinal position, jet exhaust deflectors, flap size and type, leading edge slat chord and deflection, and gap and overlap of the slats and flaps. The force tests were made in full-scale tunnel with a model having an unswept untapered wing and powered by four simulated high-bypass-ratio turbofan engines. Author

N71-23127*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
INVESTIGATION OF THE AERODYNAMIC CHARACTERISTICS OF A HYPERSONIC TRANSPORT MODEL AT MACH NUMBERS TO 6
James C. Ellison Washington Apr. 1971 80 p refs
(NASA-TN-D-6191; L-7478) Avail: NTIS CSCL 01C

A wind tunnel investigation was conducted at subsonic, supersonic, and hypersonic speeds to determine the aerodynamic characteristics of a blended wing-body configuration. Data were obtained for the configuration with a single vertical tail, a flow-through inlet, and elevons deflected from 5 deg to −20 deg. At a Mach number of 6 and a Reynolds number of 21.6 × 1 million, the configuration had a maximum lift-drag ratio of 5.0 with no trim penalty. Based on the selected center of gravity position of 56.4 percent of the model length, the configuration was stable in all directions over the Mach number range. Results of analytical methods agreed with the data at zero elevon deflection for the range of angle of attack from 0 deg to 6 deg at all Mach numbers. Author

N71-23212# Boeing Co., Wichita, Kans.
THE EFFECT OF ACTIVE CONTROLS ON STRUCTURAL RESPONSES
Clifford F. Newberry, James I. Arnold, and Gerald J. Kass *In* AGARD Freq. Response Functions and Human Pilot Modelling Mar. 1971 p 21–44 refs (See N71-23210 12-01)
Avail: NTIS

The use of an active control system on large flexible aircraft to improve flying qualities, ride qualities, and to alleviate loads require a good mathematical model. The number of modes to be included is treated from a standpoint of stability and for structural loads evaluation. The verification of the model during flight testing is discussed. Frequency response, transient response, and random response techniques are presented. Presented are two examples; one dealing with a lower structural mode frequency that affects the handling qualities and ride qualities of the aircraft and the other deals with a higher frequency mode that is a stability problem. Consideration for artificial damping of the flutter mode is also presented. Author

N71-23213# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
TRANSFER FUNCTIONS OF FLEXIBLE AIRCRAFT TO ATMOSPHERIC TURUBLENCE [FONCTIONS DE TRANSFERT D'UN AVION SOUPLE A LA TURBULENCE]
G. Coupry *In* AGARD Freq. Response Functions and Human Pilot Modelling Mar. 1971 p 45–48 refs In FRENCH (See N71-23210 12-01)
Avail: NTIS

Computation and measurement of the transfer function of an aircraft flexible to atmospheric turbulence are reported. After a

survey of the usable turbulence models, the computation of the transfer function for isotropic turbulence is discussed; it is shown that it is hardly more complicated than in the case of uniform turbulence. Finally, the methods for measuring the transfer function are described. Author

N71-23234# Air Line Pilots Association, International, Washington, D. C.

FACT SHEET ON THE AIR LINE PILOTS ASSOCIATION ANNUAL AIR SAFETY FORUM

21 Jul. 1970 49 p refs Presented at 17th ALPA Air Safety Forum, San Francisco, 20–22 Jul. 1970

Avail: NTIS

The Air Line Pilots Association Air Safety Forum is a meeting of all segments of the aviation community. It is devoted solely to air safety and has been sponsored by the Air Line Pilots Association in the public interest in every year since 1953. The reasons for the Forum are threefold: (1) to stimulate an interest in air safety; (2) to promote an exchange of safety information between pilots, and representatives of the aviation industry and government, and (3) to develop recommendations to improve the safety of air travel. Participants in the ALPA Forums are pilot and flight attendant safety experts from all air lines, plus safety representatives from the air line companies, aircraft manufacturers, government agencies concerned with aviation, airport operators, the military services and many other segments of the national and international aviation community. Subjects covered are those timely ones concerned with increasing the efficiency and safety of air line flying. They vary from year to year, but the stress is upon those associated with air safety problems considered to be currently the most critical. They are covered by various means, including panel presentation, technical papers, open discussion, guest speakers and field trips. Author

N71-23296*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

AN INVESTIGATION OF SONIC BOOM FOR STRAIGHT- AND DELTA-WING SPACE SHUTTLE ORBITERS

Raymond M. Hicks, Joel P. Mendoza, and Lionel L. Levy, Jr. Apr. 1971 26 p refs

(NASA-TM-X-62030) Avail: NTIS CSCL 20A

Wind tunnel tests were conducted to determine the sonic boom characteristics of straight wing and delta wing space shuttle orbiters during reentry into the earth's atmosphere. Two different trajectories were analyzed for the delta wing orbiter while one trajectory was considered for the straight wing orbiter. Both trajectory and angle of attack were found to have strong effects on the level of sonic boom overpressure under the flight path of the vehicle. Author

N71-23387# Naval Ordnance Lab., White Oak, Md.

A NEW APPROACH TO THE DETERMINATION OF THE STEADY STATE INFLATED SHAPE AND INCLUDED VOLUME OF SEVERAL PARACHUTE TYPES IN 24 GORE AND 30 GORE CONFIGURATIONS

William P. Ludtke 3 Oct. 1970 56 p refs

(AD-718808; NOLTR-70-178) Avail: NTIS CSCL 1/3

N70-27898 documented a new method of determining the steady-state inflated shape and included volume of several types of parachutes in 12-gore and 16-gore configurations. This report uses the methods and technique of **N70-27898** to extend the data to 24-gore and 30-gore configurations of the flat circular, 10 percent extended skirt, 16 percent porous ring slot and 24 percent porous ribbon parachutes. The inflated elliptical shapes of the various canopies were obtained from photographic records of the wind-tunnel tests at various velocities from 17 mph to 200 mph using parachute models of approximately 40-inch flat diameter. The steady-state canopy volume includes the volume of the billowed gore panel and an air volume ahead of the canopy skirt hem. The results of this investigation are particularly applicable to studies of canopy stress analysis and determination of the volume of air which must be collected during canopy inflation process for use in the calculation of opening-shock force. Author (GRA)

N71-23410# Advisory Group for Aerospace Research and Development, Paris (France).

LESSONS WITH EMPHASIS ON FLIGHT MECHANICS FROM OPERATING EXPERIENCE, INCIDENTS AND ACCIDENTS

Mar. 1971 301 p refs Presented at the 37th Meeting of the Flight Mech. Panel of AGARD, Baden-Baden, 20–23 Oct. 1970

(AGARD-CP-76-71) Avail: NTIS HC $6.00/MF $0.95

Detailed accident and incident investigations, flight control systems developments and operational performance recordings are used to optimize aircraft flight mechanical parameters. Considerable emphasis is placed on human factors engineering for aircraft safety requirements. For individual titles see: N71-23411 through N71-23431.

N71-23411# Air Registration Board, London (England).

A BRIEF REVIEW OF SOME SAFETY STUDIES BASED ON OPERATIONAL FLIGHT RECORDING

J. C. Chaplin *In* AGARD Lessons with Emphasis on Flight Mech. from Operating Experience, Incidents and Accidents Mar. 1971 26 p refs (See N71-23410 12-02)

Avail: NTIS HC $6.00/MF $0.95

In order that advances in aviation safety may continue to be made without unnecessarily adding to cost, it is essential to be able to study the effectiveness of current regulations to determine whether or not they are acting in the manner expected. Methods which have been developed to abstract and examine data of safety interest are outlined. The fields of operations and airworthiness are both considered and the relative places of statistical data on the one hand and the more detailed study of isolated events are discussed. Examples are given of some of the results which have been obtained. The importance of the close links which have been developed with the operator is emphasized. Author

N71-23412# National Aerospace Lab., Amsterdam (Netherlands).

OPERATIONAL FLIGHT RECORDING AND ITS IMPACT ON FLIGHT SAFETY AND AIRCRAFT DESIGN

T. Van Oosterom *In* AGARD Lessons with Emphasis on Flight Mech. from Operating Experience, Incidents and Accidents Mar. 1971 19 p refs (See N71-23410 12-02)

Avail: NTIS HC $6.00/MF $0.95

Flight operational experience and results from incident and accident analyses are important sources of basic information for improving flight safety and aircraft design. These sources can be effectively explored by in-flight recording of data, which define the flight condition, the navigational environment and the technical functioning of the aircraft. Present aircraft integrated data systems (AIDS) provide an extensive data acquisition capability and allow for automatic data processing. The main technical features of these systems and the relevant data processing equipment are reviewed from a users' point of view. A survey is given of present and possible future applications of AIDS with emphasis on flight safety and aircraft design data recording. Some specific examples are discussed which illustrate the usefulness of flight recording. Author

N71-23413# General Dynamics/Fort Worth, Tex.

PROVING THE OPERATIONAL CAPABILITY OF A HIGH PERFORMANCE FLIGHT CONTROL SYSTEM

E. C. Livingston, Jr. *In* AGARD Lessons with Emphasis on Flight Mech. from Operating Experience, Incidents and Accidents Mar. 1971 12 p (See N71-23410 12-02)

Avail: NTIS HC $6.00/MF $0.95

Two generalized approaches to the development and proof

of a high performance flight control system are examined. The first approach is conventional in that no more than minimal simulation is utilized to confirm the system analysis and design. In the second approach, extensive use is made of complete closed-loop simulation, including an accurate dynamic model of the airframe, to confirm analysis and design. Examples encountered in the utilization of these two approaches are provided in order to illustrate the benefits of one approach over the other. Experience gained from the utilization of both of these approaches has shown the latter to be the best. The extensive use of flight simulators and an airframe test stand assures that the system will meet requirements after minimal retrofit and flight test. Author

N71-23414# Smiths Industries, Ltd., London (England).
THE OPERATIONAL PROVING OF AUTOMATIC FLIGHT CONTROL SYSTEMS IN THE APPROACH AND LANDING PHASE
R. H. Ashforth *In* AGARD Lessons with Emphasis on Flight Mech. from Operating Experience, Incident and Accidents Mar. 1971 10 p (See N71-23410 12-02)
Avail: NTIS HC $6.00/MF $0.95

The Hawker Siddeley Trident aircraft equipped with a flight control system that covers both automatic approaches and automatic landings is studied. The flight control system comprises the SEP 5 autopilot which is triplex in the pitch and roll axis and duplex in yaw. The lessons learnt during the flight trails and also as a result of the service experience are discussed. Changes made to the original design as a result of this experience, applicable to the approach and landing phase, are described in relation to the different levels of clearance. The second part of the paper covers the in-service recording and statistical proving of the automatic landing system. Author

N71-23415# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
OPERATIONAL PROVING OF AUTOMATIC FLIGHT CONTROL SYSTEMS FOR V/STOL FIGHTER AIRCRAFT
G. Kissel and H. Schmidtlein (Vereinigte Flugtech. Werke G.m.b.H., Bremen, West Germany) *In* AGARD Lessons with Emphasis on Flight Mech. from Operating Experience Incidents and Accidents Mar. 1971 26 p refs (See N71-23410 12-02)
Avail: NTIS HC $6.00/MF $0.95

Four different types of automatic flight control systems for V/STOL fighter aircraft were flight tested within the past years. The VJ 101 C aircraft makes use of pure jet-thrust-modulation control in the thrust sustained flight regime for rolling and pitching and thrust vector control for yawing. The VAK 191 flying bedstead uses puff-pipe (bleed air) control with additional thrust augmentation for pitching. The main characteristics of the systems are: (1) stability augmentation system with high authority superimposed on the mechanical flight control system versus fly by wire system; (2) integrating control system versus proportional system; (3) pure VTOL versus V/STOL capability; (4) pure thrust modulation control versus puff-pipe control; and (5) puff-pipe control by means of fly by wire with mechanical back up. With all four systems acceptable handling qualities could be reached but it is shown that, especially in case of thrust modulation where the aircraft has nonlinear characteristics, for large control inputs a nonlinear control system gives higher stability. Author

N71-23416# Deputy Chief of Naval Operations (Development), Washington, D.C.
DESIGN LESSONS LEARNED FROM THE OV-10A BRONCO
Hugo G. Sheridan *In* AGARD Lessons with Emphasis on Flight Mech. from Operating Experience, Incidents and Accidents Mar. 1971 13 p (See N71-23410 12-02)
Avail: NTIS HC $6.00/MF $0.95

The OV-10A Bronco is one of the aircraft designed specifically for low level counterinsurgency warfare. The original design requirements for the aircraft as well as the engineering changes found necessary during the flight test stage are reviewed. Use of the Bronco in combat operations in Southeast Asia is summarized including loss and damage rate. As a result of these combat operations, conclusions are drawn as to the validity of the original requirements for the OV-10A. Design requirements desirable for the next counterinsurgency aircraft in light of the experience in Southeast Asia are recommended. Author

N71-23417# Hawker Siddeley Aviation, Ltd., Woodford (England).
LESSONS FROM OPERATION AND TRIALS OF TWIN TURBO PROP AIRCRAFT ON ROUGH AIRFIELDS
M. J. Taylor *In* AGARD Lessons with Emphasis on Flight Mech. from Operating Experience Incidents and Accidents Mar. 1971 13 p refs (See N71-23410 12-02)
Avail: NTIS HC $6.00/MF $0.95

Trials and operations of a civil twin turboprop airliner and of its military counterpart have taken place over a period of nearly ten years. During this time both measured data and operating experience have been accumulated from movements on unprepared airfields. In particular the investigation into two landing accidents involving the civil type has led to performance measurements on grass and hard surfaces. Information is given on the following: (1) undercarriage load measurements; (2) airframe contamination and superficial damage; and (3) aeroplane performance. Author

N71-23418*# National Aeronautics and Space Administration, Washington, D.C.
AVOIDANCE OF AIRCRAFT TRAILING VORTEX HAZARDS
William A. McGowan *In* AGARD Lessons with Emphasis on Flight Mech. from Operating Experience, Incidents and Accidents Mar. 1971 23 p refs (See N71-23410 12-02)
(NASA-TM-X-67125) Avail: NTIS CSCL 01C

Trailing vortices have been the cause of aircraft accidents. Results of accident investigations, theoretical exercises, wind tunnel experiments, and flight tests are used to describe the formation and severity of trailing vortices and the spatial extent of their influence, including factors governing persistence. This information is then used to outline procedures for ready application by pilots, tower operators, and those concerned with the flow of traffic during tactical operations. The procedures provide the necessary appreciation of the physical attributes of trailing vortices, the potential hazards involved when encountering them, and how best to avoid the dangerous portions of the wake during flight operations. Schemes under investigation to monitor remotely both the trailing vortex location and intensity in the airport area and to prohibit formation of high intensity vortices, through aircraft design, are discussed. Author

N71-23419# Mississippi State Univ., State College. Dept. of Aerophysics and Aerospace Engineering.
THE HANDLING QUALITIES REQUIRED FOR SAFE OPERATION OF SINGLE ENGINE BOUNDARY LAYER CONTROLLED AIRCRAFT IN THE STOL MODE
S. C. Roberts *In* AGARD Lessons with Emphasis on Flight Mech. from Operating Experience, Incidents and Accidents Mar. 1971 16 p refs (See N71-23410 12-02)
Avail: NTIS HC $6.00/MF $0.95

Operations of single engine, boundary layer control, STOL aircrafts since 1958 are reported. The vehicles have been the high lift, super cub L-21, the modified Cessna L-19, the XAZ-1, and the XV-11A with wing loadings ranging from 13 lb/sq ft to 28 lb/sq ft. All of these aircraft had a distributed suction boundary layer control system for lift augmentation and XAZ-1 and the XV-11A also had shrouded propellers for static thrust augmentation. The performance, stability and control, and handling qualities of these aircraft have been evaluated and considerable experience gained in the operational aspects of such STOL aircraft with regard to the handling qualities required for safe operation in the STOL mode. Author

N71-23420# Breguet-Aviation, Velizy (France).
ESTABLISHING SAFETY MARGINS FOR THE TAKE OFF AND APPROACH OF THE BREGUET 941 [ETABLISSEMENT DES MARGES DE SECURITE AU DECOLLAGE ET A L'ATTERRISSAGE POUR LE BREGUET 941]
J. Bastidon *In* AGARD Lessons with Emphasis on Flight Mech. from Operating Experience, Incidents and Accidents Mar. 1971 9 p (See N71-23410 12-02)
Avail: NTIS HC$6.00/MF$0.95

The safety margins to be considered are of the two following types: (1) speed margins (takeoff and approach speed); and (2) field length margins. These two margins are examined and discussed considering the BR 941. Determination of these margins is based on theoretical considerations, flight measurements and operational test results. Allowance is also made for discussions determining special conditions for civil airworthiness of this airplane. Author

N71-23421# Naval Air Systems Command, Washington, D.C.
LOW ALTITUDE HIGH SPEED FLIGHT EXPERIENCE
Ralph C. A'Harrah *In* AGARD Lessons with Emphasis on Flight Mech. from Operating Experience, Incidents and Accidents Mar. 1971 13 p refs (See N71-23410 12-02)
Avail: NTIS HC$6.00/MF$0.95

An extensive flight test evaluation of the operational capabilities of contemporary military aircraft in performing low altitude missions is reported. The particular test phase being reviewed, namely the visual target acquisition test, involved 8 aircraft and 200 pilots making more than 400 low altitude sorties. Assigned penetration speeds ranged from 175 to 550 Knots. Two altitude corridors were assigned: minimum safe altitude to 400 feet and 500 to 900 feet above the terrain. Author

N71-23423# National Aero- and Astronautical Research Inst., Amsterdam (Netherlands).
MAN/MACHINE COMBINATION IN THE LIGHT OF SAFETY REQUIREMENTS
F. W. L. Herckenrath, J. J. P. Moelker, and C. M. Ramsey *In* AGARD Lessons with Emphasis on Flight Mech. from Operating Experience, Incidents and Accidents Mar. 1971 10 p refs (See N71-23410 12-02)
Avail: NTIS HC$6.00/MF$0.95

A description is given of a few limiting factors in man and their bearing upon aircraft design. Examples are given of limitations in attention, perception, learning, memory and intelligence, and decision making. Present design deficiencies are considered in the light of crew training and procedures. It is stressed that from the earliest conception of a design close cooperation between designers, safety organisations and prospective operators is of vital importance to assure safety in aerospace operations. Author

N71-23424# National Aeronautical Establishment, Ottawa (Ontario).
REVIEW OF SEVERAL FACTORS RELEVANT TO JET UPSETS
B. Caiger *In* AGARD Lessons with Emphasis on Flight Mech. from Operating Experience, Incidents and Accidents Mar. 1971 11 p refs (See N71-23410 12-02)
Avail: NTIS HC$6.00/MF$0.95

Various contributory factors to jet upsets are reviewed covering instrument or control system failures and severe turbulence encounters. Related problems of pilot disorientation are discussed. The need for detailed analyses of upsets is emphasized. It is concluded that well designed autopilot systems may provide more effective control in severe turbulence encounters than the human pilot, but that suppression of primary structural modes and the use of head-up displays are still desirable to alleviate the pilot's difficulties. Author

N71-23425# Boeing Co., Seattle, Wash. Commercial Airplane Group.
APPROACH PATH CONTROL FOR REDUCED NOISE AND IMPROVED TRAFFIC CAPACITY
D. R. Clifford *In* AGARD Lessons with Emphasis and Flight Mech. from Operating Experience Incidents and Accidents Mar. 1971 22 p refs (See N71-23410 12-02)
Avail: NTIS HC$6.00/MF$0.95

Final approach control for transport aircraft consists primarily in aerodynamic performance during cruise. The specific objectives defined for the Boeing 727 and 737 in this respect, and the boundary layer control research with the 707 prototype, are outlined, together with results achieved. Steep angle, decelerating, and curving approaches have been considered singly and in combination. A simple speed control for decelerating approach on the normal glidepath angle is under development for the 747 and research activities include extending the capability of high quality area navigation equipment to control of flightpath, speed and configuration on final approach so as to minimize noise. Described are the operational characteristics of the airborne system for terminal path guidance on reduced noise trajectories, including the system configuration, functions of key elements, redundancy requirements, control law aspects, and cockpit displays. Author

N71-23426# National Aeronautics and Space Council, Washington, D.C.
A REVIEW OF V/STOL AIRCRAFT ACCIDENTS IN THE US
John H. Enders and William E. Thurman *In* AGARD Lessons with Emphasis on Flight Mech. from Operating Experience, Incidents and Accidents Mar. 1971 14 p refs (See N71-23410 12-02)
Avail: NTIS HC$6.00/MF$0.95

V/STOL research and development aircraft accidents have occurred for the same major reasons and over the same operational phase spectrum as have accidents to conventional aircraft. Excluding hover and transition phases from the operational phases, a pattern of accident distribution of V/STOL aircraft is similar to that for conventional aircraft - about 55-60% during landing, about 20% in cruise, and about 20% during takeoff. The pattern of accidents suggests no clearly dominant remedial action to reduce these accidents across-the-board, but increased attention in each of the cause factor areas will effect an improvement. Nearly every accident investigation prompted changes in either design, methods of operation, management structure, pilot training methods, or maintenance procedures. Author

N71-23427# Ministry of Defence, London (England).
V/STOL IN THE ROYAL AIR FORCE: SOME LESSONS FROM THE FIRST 18 MONTHS
R. G. Lofting *In* AGARD Lessons with Emphasis on Flight Mech. from Operating Experience, Incidents, and Accidents Mar. 1971 4 p (See N71-23410 12-02)
Avail: NTIS HC$6.00/MF$0.95

Some 18 months of V/STOL operations with the Harrier ground attack and reconnaissance aircraft have been completed and the aircraft's flight safety record during this period is discussed. The record has been encouragingly good, taking into consideration the novel problems of V/STOL operation, and field covered by the complete Harrier flight safety record is not a large one. Selected are the following four topics from the Harrier flight safety record which lie reasonable close to flight mechanics: (1) stability and control; (2) exhaust gas reingestion; (3) ejection facilities; and (4) control system. Author

N71-23428# Messerschmitt-Boelkow G.m.b.H., Munich (West Germany).
V/STOL ACCIDENTS OR INCIDENTS
O. Richarz *In* AGARD Lessons with Emphasis on Flight Mech. from Operating Experience, Incidents and Accidents Mar. 1971

10 p (See N71-23410 12-02)
Avail: NTIS HC $6.00/MF $0.95

Performance tests on two models of the VJ 101C VTOL high performance aircraft are reported and observed accidents connected with flight mechanical aspects are analyzed. Four out of the five accidents reported had something to do with hot gases and recirculation. A great deal of the recirculation problems experienced were directly connected to the triangular arrangement of the aircraft's 6 engines. G.G.

N71-23429# Sud-Aviation, Toulouse (France).
ALL WEATHER SUD/LEAR LANDING SYSTEM INSTALLED ON THE CARAVELLE [SYSTEME D'ATTERRISSAGE TOUS TEMPS SUD/LEAR INSTALLE SUR CARAVELLE]
G. Payeur *In* AGARD Lessons with Emphasis on Flight Mech. from Operating Experience, Incidents and Accidents Mar. 1971 10 p (See N71-23410 12-02)
Avail: NTIS HC $6.00/MF $0.95

Experience with the all weather SUD/LEAR landing system confirms its reliability in phase 3a automatic approach and landing requirements. The system encorporates a flash warning signal on the panel in front of the flight captain that combines all essential warnings relating to aircraft flight control and integrates in particular the following warnings: (1) HZ-4 and MR-4 indicator flags; (2) beam error detector warnings; (3) autopilot warnings; and (4) altitude error warnings transmitted by the radio altimeter AF-and servo-mechanism unit. The fact that the warnings are combined in a single flash enables the flight captain to continue outside the aircraft and yet perceive within his immediate field of vision a possible malfunction flash signal; he can make a decision (down to 50 ft) to continue the approach or to initiate go-around. Transl. by G.G.

N71-23430# Army Aviation Systems Command, St. Louis, Mo.
PROBLEMS ENCOUNTERED IN NAP OF THE EARTH FLYING AND THEIR EFFECT ON AIRCRAFT DESIGN MISSION PERFORMANCE
Lawrence R. Dewey, Jr. *In* AGARD Lessons with Emphasis on Flight Mech. from Operating Experience, Incidents and Accidents Mar. 1971 5 p refs (See N71-23410 12-02)
Avail: NTIS HC $6.00/MF $0.95

Reviewed are some of the design problems that are accentuated by tactical helicopter maneuvering close to ground. Considered are aerodynamic coupling effects that cause the aircraft to roll during climb with sudden forward pitching for a gun run on target, and dynamic structural aircraft vibrations during low level high speed terrain avoidance maneuvers. Proposed safety measures include an automatic information and warning system for the pilot and safety margins that realistically encompass fatigue dynamics inherent in close to ground operations. G.G.

N71-23431# Ministry of Technology, London (England).
WEATHER AS A FACTOR IN FATAL ACCIDENTS INVOLVING CIVIL TRANSPORT AIRCRAFT
J. Burnham *In* AGARD Lessons with Emphasis on Flight Mech. from Operating Experience, Incidents and Accidents Mar. 1971 21 p refs (See N71-23410 12-02)
Avail: NTIS HC $6.00/MF $0.95

An analysis is given of the importance of weather in fatal accidents involving civil transport category aircraft during the period 1946-69. Out of a total of 1,433 accidents involving 25,801 fatalities, weather is known to have been a factor in 318 accidents involving 6,778 fatalities, and may have been involved in others. The average of 13 accidents per year in which weather was involved comprise about 10 per year in poor visibility, 2 per year due to gusts and 1 per year due to icing and other weather hazards. The only type of weather accident which has increased in frequency in recent years is that of approach and landing in poor visibility. Author

N71-23487# RAND Corp., Santa Monica, Calif.
FUEL-OPTIMAL RETROTHRUSTED SOFT LANDING THROUGH AN ATMOSPHERE. PROJECT RAND
M. L. Juncosa Dec. 1970 33 p refs
(Contract F44620-67-C-0045)
(AD-718405; R-515-PR) Avail: NTIS CSCL 1/2

A simple analysis of the problem of achieving a soft landing for airdrop by fitting the payload with retrorockets, and a direct iterative numerical procedure for determining the switch-on point for minimal fuel consumption, in terms of either time or altitude. Through appropriate reversals of sign, the formulas may also be used for ascent trajectories of full-thrust, vertically boosted rockets where the assumption of a constant gravity field is acceptable. Since the unretrothrusted portion of the descent is identical with free fall, the dynamical equations are integrable in closed forms. For a constant atmosphere, closed form analytic solution is also obtained for the retrothrusted descent. For an exponentially varying atmosphere, however, one cannot escape a numerical integration of the dynamical equations. Author (GRA)

N71-23488# Naval Air Engineering Center, Philadelphia, Pa. Engineering Dept.
SHIPBOARD TEST PROCEDURE FRESNEL LENS OPTICAL LANDING SYSTEM MK 6 MOD 2
Wesley F. Davis 19 Jan. 1971 88 p
(AD-718335; NAEC-ENG-7656) Avail: NTIS CSCL 1/5

This procedure is a guide to be used by the Test Engineer, Field Service Representative or Test Officer for Shipboard testing the Fresnel Lens Optical Landing System MK 6 MOD 2 after initial installation or the completion of a major change, overhaul or extensive repairs. These tests are necessary to demonstrate the integrity of the installation as well as functional readiness for operation. Author (GRA)

N71-23498# Aeroplane and Armament Experimental Establishment, Boscombe Down (England).
BEAGLE B125 BULLDOG G-AXEH (LYCOMING 10-360A1C). PART 1: PREVIEW HANDLING TRIALS
T. Heffernan, J. J. Lee, and R. Hargreaves 14 Oct. 1970 17 p
(AAEE-963-Pt-1) Avail: NTIS

A brief handling assessment has been made of the Beagle Bulldog at a representative training loading. The overall impression of the aircraft was most favorable, and it is well suited to the trainer role. No handling problems were encountered and the characteristics were even better than those of the Pup 150. The aircraft was easy to fly while providing scope to achieve precision. Ground handling was excellent, pedal forces being lighter than on the Pup. Stability and control were good about all axes. Stalling tests showed that the controls were effective throughout and recovery was prompt. The aircraft could be made to spin more easily than the Pup and the rate of rotation, though fast, was acceptable in view of the stable nature of the spin. Aerobatics were if anything better than on the Pup die to the clear view canopy, constant speed propeller, and larger rudder. Recommendations are made for improving the cockpit layout. Author (ESRO)

N71-23538# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STABILITY AND CONTROLLABILITY OF SUPERSONIC AIRCRAFT
V. Lutskii et al 4 Dec. 1970 13 p ref Transl. into ENGLISH from Aviatsiya i Kosmonavtika (Moscow), no. 4, 1970 p 25-27
(AD-718474; FTD-HC-23-600-70) Avail: NTIS CSCL 1/3

A general discussion is presented of various factors which affect the stability and controllability of supersonic aircraft. GRA

N71-23696# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Berlin (West Germany). Inst. fuer

Turbulenzforschung.

SOUND GENERATION BY A DISTURBED SIMPLE LAMINAR JET

Alfons Michalke Jan. 1971 38 p refs
(DLR-FB-71-02) Avail: NTIS; ZLDI Munich: 9,70 DM

The sound generation by a part of a circular jet is investigated theoretically. The investigation is limited to that part of the jet for which a linear theory is applicable. In this "linear flow region there exists a laminar jet flow approximately parallel with small spatially growing disturbances. The source term of the Lighthill equation and the sound far-field is calculated for this laminar fluctuating jet flow. For the special jet flow produced by a cylindrical vortex sheet the directivity of sound is discussed at various Strouhal numbers and Mach numbers. It is found that the directivity depends strongly on the Strouhal number and is quite different for axisymmetric and azimuthal source components. Author (ESRO)

N71-23720# Civil Aeronautics Board, Washington, D.C.

CAPTIVES OF INDUSTRY

Whitney Gillilland 1970 9 p refs Presented at Braniff Intern. Airlines Management Club, Dallas, 16 Nov. 1970
Avail: Issuing Activity

The role played by the CAB in determining passenger fares, granting new routes, and encouraging competition among air carriers and among aircraft manufactures is described. It is felt that the air transportation system which has evolved is characterized by operational efficiency, excellent quality and extent of services, economy, and reasonable fare levels. N.E.N.

N71-23748# School of Aerospace Medicine, Brooks AFB, Tex.

NOISE ASSOCIATED WITH AIRBORNE OPERATION OF C-141A AIRCRAFT Final Report, 1 Mar. 1969 – 28 Feb. 1970

Donald C. Gasaway Dec. 1970 34 p refs
(AD-718097; SAM-TR-70-74) Avail: NTIS CSCL 20/1

Acoustic noise measurements obtained within several Lockheed C-141A aircraft during various operational missions are reported; factors of aeromedical significance are identified and described; and methods with which undesirable effects can be controlled are proposed. Author (GRA)

N71-23818# Air Force Systems Command, Wright Patterson AFB, Ohio. Foreign Technology Div.

STABILITY AND CONTROLLABILITY OF SUPERSONIC AIRCRAFT

V. Lutskii et al 3 Dec. 1970 10 p Transl. into ENGLISH from Aviatsiya i Kosmonautika (USSR), no. 10, 1969 p 21 – 23
(AD-718285; FTD-HC-23-596-70) Avail: NTIS CSCL 1/3

Controllability and stability are interrelated and determine one another. The characteristics of the stability and controllability of modern supersonic aircraft in longitudinal and lateral movement are analyzed. Author (GRA)

N71-23822*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

NOZZLE PERFORMANCE MEASUREMENT ON UNDERWING NACELLES OF AN F 106 UTILIZING CALIBRATED ENGINES AND LOAD CELLS

Harold W. Groth [1971] 21 p refs Presented at 7th Propulsion Joint Specialist Conf., Salt Lake City, 14 – 18 Jun. 1971; sponsored by AIAA
(NASA-TM-X-67816) Avail: NTIS CSCL 01C

Installation effects on turbojet engine exhaust nozzles over a range of flight Mach number from 0.60 to 1.30 are discussed. Two J85-13 afterburning turbojet engines were mounted in underwing nacelles. Exhaust nozzle propulsion efficiency is being measured using load cells, calibrated engines, and flight calibrated nacelle tare forces. Reference nozzles of known performance were used to determine nacelle tare forces. Analysis of flight calibration data shows that the system is capable of determining nozzle efficiency to a one-sigma random error + or – 1.5 percent. Author

N71-23880*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

A WIND TUNNEL INVESTIGATION OF STATIC LONGITUDINAL AND LATERAL CHARACTERISTICS OF A FULL-SCALE MOCKUP OF A LIGHT TWIN ENGINE AIRPLANE

Marvin P. Fink, James P. Shivers, and Charles C. Smith, Jr. Washington Apr. 1971 289 p refs
(NASA-TN-D-6238; L-7607) Avail: NTIS CSCL 20D

The model was a full-scale mockup of a light, twin-engine, low-wing monoplane. Tests were made over an angle-of-attack range of – 4 deg to 24 deg and over a sideslip range of + or – 8 deg at thrust coefficients of 0, 0.19, and 0.28. Control effectiveness and hinge moments were determined for a full range of deflections on the aileron, elevator, and rudder. Downwash surveys were made in the region of the horizontal tail. Limited tests were made with simulated ice on the wing and horizontal tail. Author

N71-23934 National Lending Library for Science and Technology, Boston Spa (England).

DESIGN OF A NONEXPANDING REFLECTOR BALLOON

E. Reininger 16 Feb. 1971 41 p refs Transl. into ENGLISH from Meteorol. Nationale (France), no. 255
(NLL-M-20326-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 4 NLL photocopy coupons

Theoretical considerations are presented for a nonexpanding reflector balloon capable of measuring the fine structure of the high stratosphere after a fast ascent through the troposphere. Balloons which expand a great deal (of Neoprene), balloons which expand very little (of natural latex), and balloons of both types inside each other are discussed. Pressure, volume, weight, ascent rate, and burst altitude are considered for each case. It is shown that the dual arrangement with the enclosed balloon for the nonexpanding material gives the best results. To achieve a maximum increase in height and minimum weight, excess pressure is permitted to escape to the atmosphere through a tube with a valve adjusted for very low internal excess pressure. The inner balloon is composed of tetrahedral sections made of metallized polyethylene. N.E.N.

N71-24021*# Lockheed-Georgia Co., Marietta.

RESIDUAL TENSILE PROPERTIES OF MATERIAL FROM C-130 CENTER WING SECTION AFTER SERVICE Final Report

L. R. Kaisand [1970] 15 p
(Contract NAS1-9485)
(NASA-CR-111828) Avail: NTIS CSCL 01B

No adverse correlation was found between the residual tensile properties of 7075-T6 material and the associated number of flight hours of the C-130 aircraft from which the specimens were extracted. Author

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N71-23116*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EXPERIMENTAL WINDAGE STUDIES FOR HIGH SPEED ALTERNATORS

S. H. Gorland and E. E. Kempke [1971] 12 p refs Proposed for Presentation at 1971 Intersoc. Energy Eng. Conf., Boston, 3 6

Aug. 1971; sponsored by SAE
(NASA-TM-X-67809) Avail: NTIS CSCL 10B

Windage tests were conducted on two concentric rotor-stator configurations, in ambient air, producing Reynolds numbers as high as 100,000. A cylindrical 12 in. diameter rotor and an 8 in. diameter Lundell-type rotor were operated at speeds up to 36,000 rpm. Gap-to-radius ratios of 0.01 to 0.04 were incorporated. Tests were also conducted with axial slots machined on the stator surface of the Lundell configuration to simulate electrical winding slots. The stators were mounted on a reaction-torque device so that viscous drag from the surface of the rotor would be measured. Tests were also conducted to determine the pumping characteristics of the conical sections of the Lundell rotor. The results are presented and discussed. Author

N71-23117*# General Electric Co., Schenectady, N.Y.
PERFORMANCE CHARACTERISTICS OF A THERMIONIC CONVERTER WITH A (110) TUNGSTEN EMITTER AND A COLLECTOR OF NIOBIUM WITH TRACE AMOUNTS OF TUNGSTEN AND NIOBIUM CARBIDE ON THE SURFACE
V. C. Wilson and S. P. Podkulski Washington NASA Apr. 1971 69 p refs
(Contract NAS3-8511)
(NASA-CR-1702; GESP-9005) Avail: NTIS CSCL 10A

A parallel plane, variable spaced converter with a tungsten emitter having the (110) planes parallel to the surface and a niobium collector was fabricated. The performance of the converter was mapped for various emitter, collector, and cesium reservoir temperatures and is compared to the performance of a converter having a tungsten (110) emitter and a nickel collector. At low temperatures (emitter temperature = 1673 K), the performance of the two converters is comparable. At higher temperatures, the performance of the tungsten (110) niobium converter is lower than the tungsten (110) nickel converter. The output increased during the first five hours of operation, but after that remained constant for about 100 hours of intermittent operation. Author

N71-23118# Minnesota Mining and Mfg. Co., St. Paul, Minn. Electrical Products Group.
SNAP-23A PROGRAM: THERMOELECTRIC CONVERTER DEVELOPMENT PROGRAM Final Report
30 Dec. 1970 360 p
(Contract AT(30-1)-4187)
(MMM-4187-1) Avail: NTIS

Research and development on phases 2 and 3 of the SNAP-23 converter development program are summarized. Development and testing of an experimental mockup converter and a prototype mockup converter is reported. Technical developments include: establishment of thermopile operating temperature, increased converter efficiency, demonstrated reliability, establishment of performance data for evaluation of production legs used in converters, and achievement of long-time operation of converters. NSA

N71-23119# Sandia Corp., Albuquerque, N.Mex. Space Power Advanced Development Div.
STUDY OF THE EFFECT OF THE EVAPORATIVE EROSION ON THERMOELECTRIC ELEMENTS ON THE PERFORMANCE OF THERMOELECTRIC GENERATORS
Ragon D. Kinney Nov. 1970 19 p refs Sponsored by AEC
(SC-RR-70-804) Avail: NTIS

A model is presented and an analysis made of the material losses from thermoelectric elements in some thermoelectric generators, and the effect of such loss on generator performance is determined. Author (NSA)

N71-23120*# General Electric Co., Schenectady, N.Y.
DEVELOPMENT AND ENDURANCE TESTING OF HIGH-TEMPERATURE CERAMIC VOLTAGE-REGULATOR TUBES
N. D. Jones Washington NASA Apr. 1971 40 p refs
(Contract NAS3-8525)
(NASA-CR-1813) Avail: NTIS CSCL 10B

The long-term performance capability of inert gas filled voltage-regulating tubes was evaluated in a high-temperature high-vacuum environment. The tube design utilized was based on earlier investigations. The feasibility of operating these tubes at a wall temperature of 800 C at 0.05 A current and at a stable running voltage of 110 v dc was demonstrated for periods exceeding 10,000 hours. Tests at room temperature indicated a stable running voltage of 108 v. A variation of tube running voltage of less than + or − 2 percent over the current range of 0.025 to 0.075 A was achieved. Author

N71-23187* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOLAR CELL AND CIRCUIT ARRAY AND PROCESS FOR NULLIFYING MAGNETIC FIELDS Patent
Luther W. Slifer, Jr., inventor (to NASA) Issued 31 Dec. 1968 (Filed 13 May 1966) 4 p Cl. 136-89
(NASA-Case-XGS-03390; US-Patent-3,419,433; US-Patent-Appl-SN-551182) Avail: US Patent Office CSCL 10A

A means of cancelling magnetic fields induced by thin waferlike circuit elements employed in space vehicles is discussed. The method attempts to negate the magnetic field without weakening the supporting honeycomb substrate of the vehicle, and provide an effective and economical means for cancellation of the fields. A reverse flow circuit array is used for the test. E.H.W.

N71-23239* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
POSITIVE dc TO NEGATIVE dc CONVERTER Patent
Eugene H. Berry and Frank J. Nola, inventors (to NASA) Issued 30 Sep. 1969 (Filed 7 Dec. 1967) 4 p Cl. 321-2; Int. Cl. H02m3/22, 3/08
(NASA-Case-XMF-08217; US-Patent-3,470,443; US-Patent-Appl-SN-688807) Avail: US Patent Office CSCL 10A

An apparatus is described for converting the output of a positive dc voltage source to a negative dc voltage of lower magnitude across a load having a common reference point with the source where capacitors are charged in series and discharged in parallel. Half wave rectifier means are used for connecting the capacitors in series and in parallel, and first and second transistor switches extending between the positive terminal of the dc source and ground for alternately connecting one end of the capacitance circuit to the positive terminal of the dc source and ground. Unidirectional conducting means are used for connecting the opposed end of the capacitance circuit to ground and to the load so as to steer the charging current to ground and to steer the discharging current through the load.
Official Gazette of the U.S. Patent Office

N71-23273# Gulton Industries, Inc., Hawthorne, Calif. Engineered Magnetics Div.
POWER SUPPLY PP-6121 ( )/U Final Technical Report
B. Bartho Dec. 1970 22 p refs
(Contract DAAB07-69-C-0068)
(AD-718869; EMD-2530; ECOM-0068-F) Avail: NTIS CSCL 10/2

The report describes the program to design, develop, and test the lightweight modular Power Supply USA ECOM PP-6121 ( )/U. The Power Supply design utilizes a considerable lower weight transformer, a patented limit control regulator circuit, and an output current and voltage sense circuit. Author (GRA)

N71-23277# Naval Nuclear Power Unit, Fort Belvoir, Va.
RADIOISOTOPIC POWER GENERATORS OF THE US NAVY,

VOLUME 4, NUMBER 4 Quarterly Operating Report, 1 Oct. –31 Dec. 1970
31 Dec. 1970 37 p
(AD-718897) Avail: NTIS CSCL 10/2

The objective of the report is to serve as a vehicle for the accumulation and dissemination of information concerning the application and operation of radioisotopic power generators (RPGs) within the Navy. It will be noted that all RPGs presently listed are radioisotope thermoelectric generators (RTGs). Unless specifically identified as an engineering evaluation, items contained in this report are presented as an impartial collection of facts, observations, and other information. An automatic weather station powered by the Sentinel-8 was emplaced on San Miguel Island off the California coast. Three URIPS-powered transponder systems were implanted near Midway Island by PMR in early October. Continued testing of the TRACS-25A indicated that the power output of this generator has dropped to approximately 5.8 watts. This required the reassignment of the Sentinel-25C3 to NUC-San Diego for use in an internal wave experiment in place of the TRACS-25A. Malfunctions in the buoy electronic systems have temporarily put the network of nuclear NOMADS in the Gulf of Mexico out of service. A contract modification was effected to make four recently ordered 25 watt generators suitable for deep sea applications.
Author (GRA)

N71-23336* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SEALED ELECTROCHEMICAL CELL PROVIDED WITH A FLEXIBLE CASING Patent
Thomas J. Hennigan, inventor (to NASA) Issued 25 Jun. 1968 (Filed 22 Oct. 1965) 3 p Cl. 136-166
(NASA-Case-XGS-01513; US-Patent-3,390,017; US-Patent-Appl-SN-502756) Avail: US Patent Office CSCL 10C

A casing structure is described that enables the lowering of the electrolyte level in the cell during the recharging cycle to better insure the proper recombination of gases at the electrodes. The casing has a bellows section capable of expanding as the pressure increases, due to a release of gases from the electrodes, and contracting upon a subsequent decrease of pressure, due to the recombination of the gases, thereby allowing a lowering and a raising of the electrolyte level within the cell.
Official Gazette of the U.S. Patent Office

N71-23348*# Florida Univ., Gainesville. Engineering and Industrial Experiment Station.
A STUDY OF GAS SOLUBILITIES AND TRANSPORT PROPERTIES IN FUEL CELL ELECTROLYTES Semiannual Report, 1 Sep. 1969 – 28 Feb. 1970
R. D. Walker, Jr. 1 Apr. 1970 31 p refs
(Grant NGL-10-005-022)
(NASA-CR-117906; SAR-9) Avail: NTIS CSCL 10C

The results reported in a continuing program of research include: (1) Measurements of the diffusion coefficients of gases in LiOH solutions were conducted. (2) A modified Percus-Yevick theory for gases in electrolytes was developed. (3) An experimental laboratory for measuring partial molal volume was completed and a few measurements were made on some controlled systems. (4) Experimental studies on the vapor pressure of LiOH solutions, and solubility of non-polar gases in LiOH were completed. In addition, the diffusion coefficients of O2 and H2 in KOH were studied in light of the free volume theory.
D.L.G.

N71-23353# Office of Naval Research, London (England).
SEVENTH INTERNATIONAL POWER SOURCES SYMPOSIUM, BRIGHTON, SUSSEX, 15 – 17 SEPTEMBER 1970
Alfredo Banos, Jr. 20 Jan. 1971 11 p refs Held at Brighton, Sussex England, 15 – 17 Sep. 1970
(AD-718833; ONRL-C-1-71) Avail: NTIS CSCL 10/2

The report gives an analysis of the nations represented, and a full account of the papers according to: (a) nature of the paper, whether research, development, production and testing, or applications; (b) the type of contributing institution, and (c) the subject matter itself, and concludes with general remarks on the highlights of meeting. The appendix contains a complete list of the papers presented.
Author (GRA)

N71-23354* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PROTECTION OF SERIALLY CONNECTED SOLAR CELLS AGAINST OPEN CIRCUITS BY THE USE OF SHUNTING DIODE Patent
Russell D. Shattuck, inventor (to NASA) Issued 8 Apr. 1969 (Filed 19 Oct. 1966) 3 p Cl. 250-212; Cl. H01j39/12
(NASA-Case-XLE-04535; US-Patent-3,437,818; US-Patent-Appl-SN-588671) Avail: US Patent Office CSCL 10A

Equipment for maintaining current flow through an array of serially connected solar cells with open connections is described. All junctions are shunted by at least one protecting diode, and each connection has at least one completely redundant shunting diode.
Official Gazette of the U.S. Patent Office

N71-23441*# Radio Corp. of America, Princeton, N.J. Astro Electronics Div.
STUDY TO DETERMINE AND IMPROVE DESIGN FOR LITHIUM-DOPED SOLAR CELLS Quarterly Report, 1 Jan. – 31 Mar. 1971
T. Faith, G. Brucker, and A. Holmes-Siedle 10 Apr. 1971 25 p refs Prepared for JPL
(Contract NAS7-100; JPL-952555)
(NASA-CR-118005; AED-R-3732F; QR-7) Avail: NTIS CSCL 10A

Results of a program to study and analyze the action of lithium in producing a recovery or spontaneous annealing of radiation damage in bulk silicon solar cells are discussed. The test vehicles used are a group of solar cells and silicon bars in the Hall-bar configuration. The source of particle irradiation being used is a 1 MeV electron beam produced by a Van de Graaff generator. Results point toward the lithium donor density gradient as being the crucial parameter in the prediction of lithium cell behavior after irradiation by electrons. Recovery measurements on a large number (110) of oxygen-rich and oxygen-lean lithium cells have confirmed that cell recovery speed is directly proportional to the value of the lithium gradient for electron fluences ranging from 3×10 to the 13th power to 3×10 to the 15th power e/sq cm. An approximate relationship between the time to half recovery (at room temperature), the lithium gradient, and the 1 MeV electron fluence was derived for oxygen-rich cells which holds for the entire range of fluences tested. For oxygen-lean cells the relation holds up to 1×10 to the 15th power e/sq cm above which a more rapid increase with fluence occurs, probably due to the greater significance of lithium depletion during irradiation.
Author

N71-23449* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SILICON SOLAR CELL WITH COVER GLASS BONDED TO CELL BY METAL PATTERN Patent
Joseph Mandelkorn, inventor (to NASA) Issued 14 Oct. 1969 (Filed 18 May 1967) 3 p Cl. 136-89; Int. Cl. H01m27/04
(NASA-Case-XLE-08569; US-Patent-3,472,698; US-Patent-Appl-SN-641420) Avail: US Patent Office CSCL 10A

A method is described in which cover glasses are attached to solar cells without using adhesives. Each cover glass is metallized in a pattern identical to the top contact pattern of a solar cell. The glass is bonded to the cell only within the metallized regions of glass and cell.
Official Gazette of the U.S. Patent Office

N71-23515*# Translation Consultants, Ltd., Arlington, Va.
ENERGY STORAGE CAPABILITIES OF SUPERCONDUCTORS IN VIEW OF HIGH POWER DISCHARGE [STOCKAGE D'ENERGIE POSSIBILITIES DES SUPRACONDUCTEURS EN VUE DES DECHARGES DE GRAND PUISSANCES]
J. Sole Washington NASA Apr. 1971 25 p refs Transl. into ENGLISH of CEA, Saclay, France report CEA-R-3243
(Contract NASw-2038)
(NASA-TT-F-13585; CEA-R-3243) Avail: NTIS CSCL 10C

The energy storage capabilities of superconductors and the associated energy release at high power is discussed. A parallel and comparison is drawn between existing energy storage mechanisms (condensers, rotating machines, reactors, batteries, explosives) and the so called superconductors as seen from French experimental results. Direct comparisons are drawn by using material evaluations, performance equations and cost price ratios. Author

N71-23518*# Pennsylvania Univ., Philadelphia. School of Chemical Engineering.
STUDY OF THE ZINC-SILVER OXIDE BATTERY SYSTEM Quarterly Reports, Oct.–Dec. 1970, Jan.–Mar. 1971
Leonard Nanis Mar. 1971 38 p ref Prepared for JPL
(Contract NAS7-100; JPL-952543)
(NASA-CR-118007) Avail: NTIS CSCL 10C

An optical method to detect the onset of the reaction zone at the rear of the porous electrode was developed to speed up the evaluation of the electrochemical Thiele parameter. The Thiele parameter compares interface reaction resistance to electrolyte ohmic resistance. The optical luminance technique senses the nature of the granular material in the porous electrode because internal reflections and refractions cause wave length dependent absorption to occur in the diffusely scattered light. The scattering effect was proven to extend into a depth of several thousandths of an inch from the rear of a porous material. Author

N71-23576# British Aircraft Corp., Stevenage (England). Guided Weapons Div.
SATELLITE FLYWHEEL Final Report
L. D. G. Barwell and J. Swain Dec. 1970 70 p refs
(Contract ESTEC-568-68-SL)
(ST-5139) Avail: NTIS

A prototype flywheel has been developed and one unit accepted for delivery to the European Space Research and Technology Center. The work has demonstrated the feasibility of using a hydrodynamic gas bearing to support the heavy, high-momentum wheel and has shown that dry starting and running up performance under 1 g gravity conditions is acceptable. Windage losses have been found experimentally to be much larger than indicated by initial calculations, nevertheless it should be possible to reduce this effect by reoptimizing the design in the light of the experimental data. This contract has paved the way for the design and construction of flywheels which could be qualified for space application. It is suggested that the next step required is to determine the effect of the launch environment on the bearing. Author (ESRO)

N71-23595# Honeywell, Inc., Montgomeryville, Pa. Livingston Electronic Lab.
DESIGN OF LIQUID AMMONIA BATTERY
J. R. Backlund Jul. 1970 86 p
(Contract DA-28-017-AMC-1542(A))
(AD-718266) Avail: NTIS CSCL 10/3

The report summarizes work done in the design of a primary reserve liquid ammonia battery capable of satisfying the particular requirements of one application which include 24-volt multitap output delivering eight voltage levels at various currents for a period of 50 hours at −65F to +160F. Efforts consisted principally of packaging of existing liquid ammonia chemistry in an advanced mechanical configuration. Major innovations in design were yielded in the form of activation mechanics and the minimization of intercell electrical leakage. All technical specifications were met by the resultant design except for voltage regulation at each output tap for the entire discharge period. Author (GRA)

N71-23604*# Gulf Radiation Technology, San Diego, Calif.
STUDY OF RADIATION EFFECTS IN SILICON SOLAR CELLS Final Report
B. C. Passenheim, R. A. Berger, J. F. Colwell, and J. A. Naber 29 Jan. 1971 109 p refs Prepared for JPL
(Contract NAS7-100; JPL-952387; Gulf Radiation Technology Proj. 6105)
(NASA-CR-118009; Gulf-RT-10482) Avail: NTIS CSCL 10B

Radiation effects in lithium-diffused bulk silicon have been studied to ascertain the nature of the defects responsible for the degradation in output of silicon devices (solar cells) irradiated by space radiation. Minority-carrier lifetime temperature dependence measurements were performed before and after irradiation with 30-MeV electrons and fission neutrons. For low fluences of 30-MeV electrons, the lifetime degradation constant for lightly diffused silicon was the same as phosphorus-doped silicon of comparable donor density. The degradation constant for lithium-rich silicon was almost twice as great. The degradation constant in lithium-diffused samples did not depend on oxygen for 30-MeV electron irradiations, but for fission neutrons the minority-carrier lifetime in oxygen-rich quartz-crucible (QC) silicon degraded at least twice as fast as in oxygen-lean float-zone (FZ) silicon. The initial recombination center introduction rate seems to be the same at all temperatures between 110 and 300 K, but because of the temperature dependence of the capture cross section, the degradation constant increases with decreasing temperature. The degradation constant was found to decrease with extended fluences. Author

N71-23700*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE GENERATION OF POLLUTION FREE ELECTRICAL POWER FROM SOLAR ENERGY
William R. Cherry Mar. 1971 18 p refs
(NASA-TM-X-65497; X-760-71-135) Avail: NTIS CSCL 10B

A study is reported to determine the feasibility of electrical power plants, utilizing solar energy, to meet future US power demands. Investigation of a pollution free method using photovolaics on the ground indicates that sunlight falling on about 1% of the land area of the 48 states could provide the total electrical power requirements of the U.S. in the year 1990. In addition, the findings indicate that while the cost of producing solar arrays by today's methods prohibits their use for large-scale terrestrial plants, the cost may become acceptable as conventional fuels become scarcer and more expensive. D.L.G.

N71-23714*# General Electric Co., Philadelphia, Pa.
ROLLUP SUBSOLAR ARRAY. VOLUME 2: DETAILED TEST RESULTS Final Report
N. Shepard, P. Perez, K. Hanson, and R. Ross, (JPL) 1 Feb. 1970 340 p refs
(Contract NAS7-100; JPL-952314)
(NASA-CR-118008; DOC-70SD4286-Vol-2) Avail: NTIS CSCL 10A

The final assembly and system tests of the 30 Watt per pound rollup solar array engineering development unit are reported. Test results are described, analyzed and compared with analysis reported previously. Thermal bending tests of sections of the BISTEM boom and results are included. The test results have been assessed with respect to future qualification testing of a rollup solar array or integration with a spacecraft and recommendations for future programs are presented. Author

N71-23780*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MEASURED PERFORMANCE OF SILICON SOLAR CELL ASSEMBLIES DESIGNED FOR USE AT HIGH SOLAR INTENSITIES
Ronald G. Ross, Jr., Robert K. Yasui, Wiktor Jaworski, Liang-Chi Wen, and Edward L. Cleland 15 Mar. 1971 217 p refs
(Contract NAS7-100)
(NASA-CR-118016; JPL-TM-33-473) Avail: NTIS CSCL 10A

The performance of three solar panel design approaches suitable for use at high solar intensities was evaluated: the second surface mirror mosaic approach, the selective bandpass filter approach, and the tilted panel approach. Extensive data are presented on the thermal and electrical characteristics of a number of specific cell/coverglass assemblies representative of these approaches. Included are data on electrical performance at intensities from 1 to 6 suns, data on thermal optical properties both before and after long term UV and proton radiation exposure, and data on the thermal mechanical properties of a number of solar cell adhesives. Author

N71-23781*# General Electric Co., Schenectady, N.Y.
A REVIEW OF THE OUTPUT PERFORMANCE OF SIX PLANAR THERMIONIC CONVERTERS WITH VARIOUS ELECTRODE MATERIALS
V. C. Wilson Washington NASA Apr. 1971 67 p refs
(Contract NAS3-8511)
(NASA-CR-1814; GESP-9012) Avail: NTIS CSCL 10A

The converters tested had electrode surfaces as follows: (1) emitter polycrystalline W, collector Nb; (2) emitter (100) oriented W etched to expose the (110) planes, collector Nb; (3) emitter (100) W, collector Ni; (4) emitter (110) W, collector Nb; (5) emitter (112) to (114) W, collector W + WO2 on Nb; and (6) emitter (110) W, collector 50%Mo-50%Nb. All of these electrode surfaces were carefully prepared and characterized before and after testing. Of the various emitters tested, emitter (2) with (100) W etched to expose (110) planes performed best. The performance of the Ni collector was superior to that of the Nb. The most output power was obtained from converter (3) - (110) W emitter with Ni collector. Author

N71-23859*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
BRAYTON POWER SYSTEM AND INTEGRATED LIFE SUPPORT SYSTEMS INTEGRATION STUDY
Eugene L. Kelsey and Robert D. Averill Washington Apr. 1971 24 p refs
(NASA-TM-X-2207; L-7385) Avail: NTIS CSCL 10B

A system integration computer study was conducted to determine the compatibility and interactions of the Brayton power system (BPS) and the integrated life support system (ILSS) when operated in an integrated mode. Existing digital and analog models of the BPS were modified to simulate an integration with the ILSS. The prime area of concern was the effect on the BPS of waste heat removal for utilization in various ILSS processes. Results of the study show that the two systems are compatible and that integration results in an increase in overall system efficiency and can be accomplished with no major changes to either system. A hardware integration for further study is not justified until a specific mission is defined. Author

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N71-23182*# Bionetics Corp., Hampton, Va. Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ANALYSES AND SENSITIVITY STUDIES RELATED TO POSTLAUNCH RECONTAMINATION OF SPACE CRAFT AND THE PROBABILITY OF CONTAMINATION OF A PLANET Final Report
30 Dec. 1970 67 p refs Prepared for JPL
(Contracts NAS7-100; JPL-953009)
(NASA-CR-117883; Rept-71-2-5) Avail: NTIS CSCL 06A

Analyses of the probability of post-launch recontamination of spacecraft and the subsequent probability of planetary contamination were performed for flyby, orbiter, and lander capsule unmanned planetary missions. Sources of microbial contamination, pertinent mission events, and spacecraft design and operating characteristics were identified and analyzed. The recontamination of the spacecraft from the shroud during the launch phase was identified as a problem common to all types of missions. The additional factor of redistribution of organisms from the nonsterile portions of the spacecraft to the attached lander capsule prior to capsule deorbit was also studied. Studies were made of the sensitivity of the probability of planetary contamination to the various factors involved in recontamination for the three types of missions. Of the various factors, the probability of particle ejection from spacecraft surfaces was found to be of greatest significance for all missions. Author

N71-23185* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
METHOD AND APPARATUS FOR CONTINUOUSLY MONITORING BLOOD OXYGENATION, BLOOD PRESSURE, PULSE RATE AND THE PRESSURE PULSE CURVE UTILIZING AN EAR OXIMETER AS TRANSDUCER Patent
Joseph R. Smith, Jr., inventor (to NASA) Issued 26 Nov. 1968 (Filed 30 Aug. 1965) 5 p Cl. 128-2.05
(NASA-Case-XAC-05422; US-Patent-3,412,729; US-Patent-Appl-SN-483885) Avail: US Patent Office CSCL 06P

An ear oximeter is used to provide arterial blood oxygen saturation. The output from the infrared photocell of the oximeter is also applied to a variable gain dc amplifier of the differential type which develops an output signal commensurate with blood pressure. The blood pressure signal is applied to a variable gain dc amplifier which blocks the dc component and suitably amplifies the ac component of the blood pressure signal to develop the pressure pulse signal. The inputs to the amplifiers and the gains of the amplifiers are adjusted so that the systolic and diastolic pressures can be obtained. Official Gazette of the U.S. Patent Office

N71-23214# Royal Aircraft Establishment, Farnborough (England). Human Factors Group.
HUMAN PILOT MODELLING
H. F. Huddleston *In* AGARD Freq. Response Functions and Human Pilot Modelling Mar. 1971 p 59-65 refs (See N71-23210 12-01)
Avail: NTIS

Human factors engineering attempts to define pilot transfer functions are considered. Input-output engineering studies show that man as a tracker: (1) behaves like a low-pass amplifier; (2) has a built in reaction time delay; (3) can, in some circumstances, generate substantial lead or lag characteristics; and (4) behaves as if he responded to some events about twice a second. Author

N71-23231# Martin Marietta Corp., Orlando, Fla.
TARGET AND TERRAIN CONTRAST EFFECTS ON AIR SEARCH AND RESCUE OBSERVER PERFORMANCE
Frank D. Fowler and Daniel B. Jones [1971] 16 p
Avail: NTIS

An experimental evaluation of the environmental and human factors which affect the ability to detect and recognize targets on the ground during search and rescue operations was conducted. The primary objectives of the evaluation were: (1) to determine the effect of target-to-background contrast on the visual angle and

slant range requirements for target detection and recognition, (2) to determine target detection threshold in both static and dynamic modes, and (3) to determine the target recognition threshold in both static and dynamic modes. Author

N71-23241# Joint Publications Research Service, Washington, D.C.

SPACE BIOLOGY AND MEDICINE TEXTBOOK

B. V. Parin et al 21 Apr. 1971 229 p refs Transl. into ENGLISH of the book 'Kosmicheskaya Biologiya i Meditsina' Moscow, Prosveshcheniye Press, 1970 p 1–224

(JPRS-52929) Avail: NTIS

The principal subjects within the field of space biology and medicine are discussed including the formulation of methods for selecting and training cosmonauts, medical measures for ensuring flight safety and maintaining normal vital functions, health and performance of cosmonauts during long spaceship flights in interplanetary space and when on planets of the solar system. Author

N71-23281# Delaware Univ., Newark. Dept. of Psychology.

PSYCHOLOGICAL CORRELATES OF PHYSIOLOGICAL CIRCADIAN PERIODICITY Final Technical Report, 1 Mar. 1969–31 Aug. 1970

George T. Hauty and F. Loren Smith 1 Feb. 1971 26 p refs

(Contract N00014-69-C-0236)

(AD-717982) Avail: NTIS CSCL 6/16

Numerous psychological and physiological assessments were made on adult male, human subjects five times a day at four-hour intervals beginning at 0700 hours. Except for these periods of assessment (approx. 30 minutes duration) no other change was imposed upon their accustomed daily routine of activity nor upon their habits of sleep. Circadian periodicity was found to be clearly manifested by physiological functions; however, little or no corresponding periodicity was demonstrated by the psychological functions assessed. Author (GRA)

N71-23339# Advisory Group for Aerospace Research and Development, Paris (France).

AN INTRODUCTION TO THE PHYSICS AND PHYSIOLOGY OF ACCELERATION

S. D. Leverett, Jr. *In its* Principles of Biodynamics Applicable to Manned Aerospace Flight Prolonged Linear and Radial Acceleration Mar. 1971 p 7–24 (See N71-23337 12-05)

Avail: NTIS

The history of acceleration and its relation to aviation medicine is reviewed along with a brief discussion of the conventional terminology for discussing these forces and the physiological effects and clinical response of the human body to these forces. A.L.

N71-23341# Advisory Group for Aerospace Research and Development, Paris (France).

A SUMMARY OF HUMAN TOLERANCE TO PROLONGED ACCELERATION

A. S. Hyde and H. W. Raab *In its* Principles of Biodynamics Applicable to Manned Aerospace Flight Prolonged Linear and Radial Acceleration Mar. 1971 p 37–56 refs (See N71-23337 12-05)

Avail: NTIS

A summary of data from literature on human tolerance to prolonged acceleration is presented in tabular and graphical form. Standard terminology derived from an AGARD-NATO agreement on the equivalence of acceleration terminology was used. Most of the graphs present the magnitude acceleration on an arithmetic ordinate axis and the duration of the exposure on a logarithmic abscissa. Separate groups of graphs are included for each direction of acceleration. Each group of graphs is further divided on the basis of the presence, absence, or character of experimental variables, such as restraint and support system, aides, and the number of subjects involved. For each graphic summary of magnitude, direction, and duration, a stick-figure illustration of the subject's attitude is given and a table provided. Each table defines each point on each graph with respect to the following variables: vector magnitude, duration, average onset (G/second), back angle, cause of termination of experimental exposure, trauma, number of subjects involved, countermeasures used, support, restraint, and the reference from which this information was obtained. A.L.

N71-23352 Deep Submergence Systems Project Office, Chevy Chase, Md.

DECOMPRESSION SCHEDULE DEVELOPMENT FOR REPETITIVE SATURATION: EXCURSION HELIUM OXYGEN DIVING

Robert C. Bornmann 1 Jun. 1970 98 p refs

(AD-718907; RR-1-70) Avail: NTIS CSCL 6/19

A twelve month program of saturation-excursion diving operations was carried out to test newly developed tables for repetitive, no-decompression excursions from helium-oxygen saturation exposures at depths between 150 feet and 600 feet. 1126 excursions were performed in accordance with the tables. The extensive test program not only validated these tables but provided as well a massive confirmation of the conservative adequacy of the extrapolated M values of Workman in this depth range. The format for saturation final decompression was also modified and improved during this program. Author (GRA)

N71-23381# Naval Electronics Systems Command, Washington, D.C.

SANGUINE SYSTEM ENVIRONMENTAL COMPATIBILITY ASSURANCE PROGRAM (ECAP). PROJECT SANGUINE Status Report, 1967–1970

Richard E. Carlson Dec. 1970 370 p refs

(AD-718828) Avail: NTIS HC$6.00/MF$0.95 CSCL 6/6

The Project SANGUINE environmental compatibility assurance program is described: its goals, work accomplished and results to date are presented. Part 1 is the program overview. The ECAP, the SANGUINE environment, the program status, and future research plans are outlined. Part 2 is a summary of major program areas. Biological and ecological assurance includes pertinent literature, electrical safety, biological and biochemical research, ecological surveys, heart pacer experiments and associated activities. Facilities construction and operation assurance addresses environmental awareness, land acquisition and joint use, installation, land restoration and coordination. Interference mitigation describes interference theories, systems and devices susceptible to extremely low frequency (ELF) interference, interference mitigation thresholds, techniques and practices. Part 3 is a description of the program management. Supporting technical documentation is provided in four appendices. Author (GRA)

N71-23382*# Scripta Technica, Inc., Washington, D.C.

A CYTOCHEMICAL STUDY OF LACTIC DEHYDROGENASE ISOENZYMES IN SOME SPECIES OF THE PROTOZOA [TSITOKHIMICHESKOYE ISSLEDOVANIYE ISOFERMENTOV LAKTATDEGIDROGENAZY U NEKOTORYKH VIDOV PROSTEYSHIKH]

I. G. Berezina NASA Apr. 1971 9 p refs Transl. into ENGLISH from Tsitologiya (Moscow), v. 12, no. 9, 1970 p 1205–1208

(Contract NASw-2036)

(NASA-TT-F-13624) Avail: NTIS CSCL 06M

Lactic dehydrogenase isoenzymes were cytochemically detected in four species of free-living Protozoa: Amoeba proteus, Spirostomum ambiguum, Paramecium caudatum and Tetrahymena pyriformis. The LDH of A. proteus and S. ambiguum is sensitive to increased concentrations of Na lactate and to high temperature, whereas the LDH of P. caudatum and T. pyriformis is sensitive to the inhibiting effect of urea. It was concluded that LDH of the H

type predominates in A. proteus and S. ambiguum, whereas P. caudatum and T. Pyriformis contain, in the main, LDH of the M type. Author

N71-23388*# Translation Consultants, Ltd., Arlington, Va.
THE EFFECT OF DIURESIS ON THE ACTIVITY OF LACTIC DEHYDROGENASE AND LEUCINE AMINO PEPTIDASE [VLIV DIURESY NA AKTIVITU LAKTATDEHYDROGENASY A LEUCINAMINOPEPTIDASY V MOCI]
A. Mojzis Washington NASA Apr. 1971 10 p refs Transl. into ENGLISH from Vnitrni Lekar. (Brno), v. 16, no. 8, 1970 p 739-744
(Contract NASw-2038)
(NASA-TT-F-13557) Avail: NTIS CSCL 06P

Increased diuresis results in increased activity of lactic dehydrogenase (LDH) and leucine amino peptidase (LAP) enzymes in urine dispensed during a certain period of time, and in decreased activity in 1 ml of urine. Reduced diuresis results in increased activity in 1 ml of urine and in reduced activity of the enzymes in urine dispensed during a certain period of time. There is, therefore, an indirect relationship between the enzymes in 1 ml of urine and the diuresis, but this relationship is not linear. There is a relatively constant activity of LDH in 1 ml of urine; in the case of LAP, however, there is an increased activity in a volume of urine dispensed during a certain period of time. Author

N71-23477# Texas Univ., Austin. Electronics Research Center.
BANDWIDTH REDUCTION OF SLEEP INFORMATION
J. A. Welch, Philip C. Richardson, Cecil W. Thomas, and Joanne M. Aldredge 10 Jul. 1970 179 p refs
(Contract F41609-69-C-0006; Grant AF-AFOSR-1782-69)
(AD-718125; TR-92; AFOSR-70-2202TR) Avail: NTIS CSCL 6/2

Many important space and military missions require maximal alertness which is dependent on adequate amounts of rest and sleep. In order to study sleep-wakefulness patterns in realistic space and military situations, it is necessary to monitor the level of arousal with simplified reliable band-limited devices. The limited time bandwidth available for the transmission of sleep information necessitates the development of a technique for data compression. This report describes the possibility of extracting sleep information from heart rate data. Several features of heart rate which contain sleep information are computed and analysis of variance is used to indicate the suitability of these measures in the pattern recognition of sleep stages from heart rate data. Author (GRA)

N71-23728*# Translation Consultants, Ltd., Arlington, Va.
LACTIC DEHYDROGENASE OF URINE IN RENAL DISEASE. 1: LACTIC DEHYDROGENASE (LDH) IN GLOMERULONEPHRITIS AND NEPHROTIC SYNDROME [LAKTATDEHYDROGENASA V MOCI U LEDVINOVYCH CHORB. 1: LAKTATDEHYDROGENASA U GLOMERULONEFRITID A NEFROTICKYCH SYNDROMU]
A. Mojzis Washington NASA Apr. 1971 10 p refs Transl. into ENGLISH from Vnitrni Lekar. (Brno), v. 16, no. 9, 1970 p 862-867
(Contract NASw-2038)
(NASA-TT-F-13558) Avail: NTIS CSCL 06P

Statistically significant increases in the average of LDH activity in acute glomerulonephritic cases and in nephrotic syndrome cases were found, but none in chronic glomerulonephritis or in glomerulonephritis in reparation phase. A statistically significant positive correlation of LDH activity in the urine and activity level of the disease was found. LDH activity in the urine was positive and statistically significant in its relation to proteinurie and leukocyturie in Addison sediment, but not to erythrocyturie or to the degree of renal inadequacy. In the case of acute glomerulonephritis, increased LDH activity in the urine may be a signal of the formation of a timely nephrotic syndrome, origin of subacute or chronic disease. In cases of chronic glomerulonephritis, increased LDH activity may be a symptom of the inception of a deteriorating process. Normal LDH activity in the urine, however, does not preclude the possibility of an advanced renal disease, since LDH activity in the urine does not depend on the degree of renal inadequacy. Author

N71-23749*# Scientific Translation Service, Santa Barbara, Calif.
CHEDIAK-HIGASHI DISEASE: SIMULTANEOUS PRESENCE OF TWO GENETIC ENTITIES [ENFERMEDAD DE CHEDIAK-HIGASHI. PRESENCIA SIMULTANEA DE DOS ENTIDADES GENETICAS]
F. D. Lascano et al Washington NASA Apr. 1971 20 p refs Transl. into ENGLISH from Rev. Clin. Espan. (Madrid), v. 110, 1 Aug. 1968 p 329-336
(Contract NASw-2035)
(NASA-TT-F-13537) Avail: NTIS CSCL 06E

A case of Chediak-Higashi disease is reported with a simultaneous case of Friedreich's hereditary spinal ataxia. The patient, deceased at the age of twenty-three, was the longest known surviving case of the genetic disease. The presence of target cells is discussed and the hematologic, neurologic, and genetic characteristics are described. Author

N71-23774 National Lending Library for Science and Technology, Boston Spa (England).
DEVELOPMENTAL RESEARCH ON DIRECTIONAL COGNITION OF TWO DIMENSIONAL SPACE: CONVERSION TO NUMERICAL FORMULAE OF DEVELOPMENT CURVES AND ANALYSIS OF ERRORS [NIJIGEN KUKAN NO HOKO NINCHI NI NANSURU HATTATSU-TEKI KENKYU: HATTATSU KYOKUSEN NO SUSHIKIKA TO AYAMARI NO BUNSEKI]
A. Katsui Mar. 1971 16 p refs Transl. into ENGLISH from Shinrigaku Kenkyu (Japan), v. 33, no. 2, 1962 p 63-69
(NLL-RTS-6354) Avail: Natl. Lending Library, Boston Spa, Engl.: £2.50; 5 NLL photocopy coupons CSCL 05E

The directional cognition in two-dimensional space of children from three to eight years old was investigated with a tachistoscopic board. Data curves show that the accuracy is about 50% for three-year olds, increases almost linearly for the four-, five-, and six-year olds, and gradually approaches to a little less than 100% for the seven- and eight-year olds. Several equations were tried to fit the curve, and the best fit was obtained by a cubic equation with three polynomials. The cognitive accuracy decreased for directions in the following order: upwards, downwards, leftwards, rightwards, upper rightwards oblique, upper leftwards oblique, lower rightwerds oblique, and lower leftwards oblique. N.E.N.

N71-23824*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SPACECRAFT COMPONENT SURVIVABILITY DURING ENTRY INTO THE JOVIAN ATMOSPHERE
Byron L. Swenson Washington Apr. 1971 17 p refs
(NASA-TM-X-2276; A-3853) Avail: NTIS CSCL 22A

In response to the concern of the scientific community regarding the possibility of an accidental biological contamination of the middle levels of the atmosphere of Jupiter by components or fragments of an unsterilized spacecraft, an analysis has been made of the survivability of such bodies upon entry along possible entry trajectories. Survivability boundaries are calculated in terms of the body size and the material specific heat capacity and are shown for various average body specific gravities and as a function of entry angle. Author

N71-23825*# Public Health Service, Phoenix, Ariz. Applied Microbiology and Planetary Quarantine Section.
SERVICES PROVIDED IN SUPPORT OF THE PLANETARY QUARANTINE REQUIREMENTS OF THE NATIONAL

AERONAUTICS AND SPACE ADMINISTRATION Quarterly Report, Jan. – Mar. 1971
Martin S. Favero Apr. 1971 23 p refs
(NASA Order W-13062)
(NASA-CR-118017; QR-33) Avail: NTIS CSCL 06M

The problem of microbial contamination of spacecraft and techniques for reducing the amount of contamination are described. The nature of the microbes found on spacecraft components and methods of training personnel in effective removal procedures are discussed. Author

N71-23978*# National Aeronautics and Space Administration, Washington, D.C.
ON THE DIFFERENCE IN THE TEMPERATURE OF THERMOPHILIC BACTERIA IN THE SOIL AND IN ARTIFICIAL NUTRIENT MEDIA [UEBER DIE VERSCHIEDENHEIT DER TEMPERATURANSPRUECHE THERMOPHILER BAKTERIEN IN BODEN UND IN KUENSTLICHEN NAEHRSUBSTRATEN]
Alfred Koch et al May 1971 9 p refs Transl. into ENGLISH from Centralblatt Fuer Bakteriologie (German), Sect. 11, v. 31, 1911 p 433 436
(NASA-TT-F-13650) Avail: NTIS CSCL 06M

An explanation of the occurrence of thermophilic bacteria in soil near Gottingen is sought. It is found that thermophilic soil bacteria grow at lower temperatures in the soil than in nutrient agar. Author

N71-24019*# Scientific Translation Service, Santa Barbara, Calif.
ANALYSIS OF CIRCADIAN RHYTHM IN BODY TEMPERATURE BY THE COSINOR METHOD [COSINOR-HO NI YORU TAION NO CIRCADIAN RHYTHM NO KAISEKI]
Ryohei Yurugi Washington NASA Apr. 1971 13 p refs Transl. into ENGLISH from Japan Air Self Defense Force, Aeromed. Lab. Rept. (Japan), v. 10, no. 4, 1970 p 181 187
(Contract NASw-2035)
(NASA-TT-F-13630) Avail: NTIS CSCL 06P

Application of Cosinor method to analysis of circadian rhythm in body temperature was examined. For this, oral temperatures of the healthy male and female subjects were measured fourteen successive times a day for seven days in the summer season, as well as the periodic cosine function, vectors of its amplitude and phase difference. The results are: (1) the Cosinor method may not be used to analyse the variation of body temperature in a narrow time band during a day. (2) the Cosinor method may be used to represent the general characteristics of circadian rhythm in body temperature by its amplitude and phase difference as a group, and (3) slight sexual differences were noted in circadian rhythm in oral temperature. Author

N71-24020*# Scientific Translation Service, Santa Barbara, Calif.
ANTIBACTERIAL BEHAVIOR OF LEUKOCYTES IN NORMAL SUBJECTS FOR CHEDIAK-HIGASHI DISEASE AND PELEGER-HUET'S ANOMALY [COMPORTAMIENTO ANTIBACTERIANO DE LOS LEUCOCITOS EN SUJETOS NORMALES, EN LA ENFERMEDAD DE CHEDIAK-HIGASHI Y EN LA ANOMALIA DE PELGER-HUET]
Mario Salazar Mallen et al Washington NASA Apr. 1971 13 p refs Transl. into ENGLISH from Rev. Invest. Salud Publica, v. 30, no. 1, Jan. – Mar. 1970 p 5 – 16
(Contract NASw-2035)
(NASA-TT-F-13637) Avail: NTIS CSCL 06E

A comparison is made of the behavior of lymphocytes in being transformed into blasts under the influence of phytohemagglutinin and phagocytes as regards its effects on multiplication of S. aureus and S. marcescens in 6 healthy individuals, one with Pelger-Huet's anomaly and another with Chediak-Higashi's disease. The blast transformation and the nucleolar index were normal in the case of Pelger-Huet's anomaly and abnormal in Chediak-Higashi's disease. This suggested a behavior similar to that found in chronic lymphoid leukemia. While Pelger-Huet's anomaly showed a tendency toward staphylococcal destruction from the first through the third hours and Serratia continued to multiply, in Chediak-Higashi's disease, the former barely appeared before the third hour. However, Serratia proliferated abundantly initially, falling off in the end. Author

N71-24173*# Minnesota Univ., Minneapolis. College of Medical Sciences.
DEVELOPMENT AND EVALUATION OF AN IMPEDANCE CARDIOGRAPHIC SYSTEM TO MEASURE CARDIAC OUTPUT AND OTHER CARDIAC PARAMETERS Final Progress Report 1 Jul. 1969 – 31 Dec. 1970
W. G. Kubicek, D. A. Witsoe, R. P. Patterson, and A. H. L. From 31 Dec. 1970 86 p refs
(Contract NAS9-4500)
(NASA-CR-114988) Avail: NTIS CSCL 06B

Engineering developments and resultant practical applications of the impedance cardiograph in obtaining information about the cardiovascular system are reported. The apparatus monitors cardiac output by thoracic electrical impedance and peripheral arterial flow as function of fluid volume change. G.G.

N71-24174*+ National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 86)
Feb. 1971 141 p refs
(NASA-SP-7011(86)) Avail: NTIS CSCL 06D

This supplement to Aerospace Medicine and Biology (NASA SP-7011) lists 453 reports, articles, and other documents announced during January 1971 in Scientific and Technical Aerospace Reports (STAR) or in International Aerospace Abstracts (IAA). The first issue of the bibliography was published in July 1964; since that time, irregular supplements have been issued. Subject coverage concentrates on the biological, physiological, psychological, and environmental effects to which man is subjected during and following simulated or actual flight in the earth's atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. In general, emphasis is placed on applied research, but references to fundamental studies and theoretical principles related to experimental development also qualify for inclusion. Author

N71-24257*# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
THE MEASUREMENT OF RADIATION EXPOSURE OF ASTRONAUTS BY RADIOCHEMICAL TECHNIQUES Quarterly Research Report, 6 Jul. – 4 Oct. 1970
R. L. Brodzinski 15 Oct. 1970 13 p refs Sponsored by NASA
(NASA-CR-118027; BNWL-1183-6) Avail: NTIS CSCL 06R

The elemental concentrations of the fecal samples from the Apollo 12 and 13 missions are being determined by neutron activation and gamma ray analysis of the induced radionuclides. Packets of the capton used as the outer thermal coating of spacecraft were proton irradiated at 108, 375, and 600 MeV. The Be-7 and Na-22 excitation functions from this material are reported. The cross sections of these induced radionuclides are compared to the previously measured activities in the skin from the Apollo 8 and 12 mission spacecraft. The concentration of Po-210 in a piece of the outer thermal coating of the Apollo 12 spacecraft was determined. The origin of the Po-210 is assumed to be the escaping decay products from the uranium in the moon. The average lunar surface uranium concentration of 0.061 ppm determined in this

manner appears to be too low by a factor of approximately 6 or 7 based on measurements of moon rocks and fines returned by the Apollo 11 and 12 missions. The construction of a semi-portable, multipurpose gamma ray spectrometer system is proposed. Suggested applications and a description of the high-efficiency, low background whole body counter and sample counter combination are given. Author

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N71-23159* Macon-Rust Co., Lexington, Ky.
STRETCHER Patent
Francis X. Lothschuetz, inventor (to NASA) Issued 26 Sep. 1967 (Filed 18 Apr. 1966) 5 p Cl. 5-82 Sponsored by NASA
(NASA-Case-XMF-06589; US-Patent-3,343,180;
US-Patent-Appl-SN-543206) Avail: US Patent Office CSCL 06B

A stretcher is described with a relatively rigid head support for giving lateral, fore-and-back, and longitudinal support to the head and neck of the patient. The stretcher also provides for support of the immobilized body of a person in a vertical position, whereby the stretcher and the person on it may be hoisted vertically through a vehicle hatch to the exterior. The principal parts of the head support can be made separable along parting lines between identical halves for incorporation in a splint stretcher. Drawings of the device are included with specifications. E.M.C.

N71-23160*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
DYNAMIC RECONSTRUCTION ERRORS IN DIGITAL TO ANALOG SYSTEMS WITH BIOMEDICAL APPLICATIONS
William P. Dotson, Jr. Washington Apr. 1971 42 p ref
(NASA-TN-D-6296; MSC-S-254) Avail: NTIS CSCL 06D

Various digital to analog conversion techniques are analyzed in order to determine the instantaneous error performance. The analytical technique is curve fitting of polynomials of zero to third order to the given digital sample points. Experimental results are also given on digitized electrocardiogram data processed through a third order polynomial, curve fitting routine. It is demonstrated that a trade off of system complexity (order of the polynomial) and transmission bandwidth is possible, with no decrease in the quality of the reconstructed data. Author

N71-23161* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
HARD SPACE SUIT Patent
Hubert C. Vykukal, inventor (to NASA) Issued 15 Oct. 1968 (Filed 19 Jul. 1966) 13 p Cl. 2-2.1
(NASA-Case-XAC-07043; US-Patent-3,405,406;
US-Patent-Appl-SN-566397) Avail: US Patent Office CSCL 06Q

A space suit is designed using a nonflexible material which has very low leakage when pressurized to the desired internal pressure, and in which the mobility of the suit is not a function of the internal pressure. This hard material is impervious to gas, and the bearings which provide the articulation are sealed in a manner which results in substantially less leakage than with a fabric suit. The suit also provides protection against thermal extremes, physical punctures, or radiation. Life support fluids pass through the covering portions, and it is possible to use multi-gas mixture in the life support system. The low resistance, high mobility articulation is provided by means of special arrangements of rotary bearings and flexible bellows. This rigid material space suit is useable over extended periods of time with substantially no deterioration. Drawings and specifications of the suit are included. E.M.C.

N71-23247# Stanford Research Inst., Menlo Park, Calif.
SURVEY OF ARTIFICIAL INTELLIGENCE Final Report
Peter E. Hart and Richard O. Duda Jan. 1971 9 p refs
(Contract N00014-68-C-0266)
(AD-718381) Avail: NTIS CSCL 6/4

The report gives a concise description of the topics covered in our surveys of two major aspects of artificial intelligence: problem solving and pattern recognition. The survey of problem solving gives separate treatment to three main approaches, the state-space, problem-reduction, and formal-logic approaches. The survey of pattern recognition covers statistical classification and scene analysis. These topics encompass major fields of research in artificial intelligence. Author (GRA)

N71-23294# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ESTIMATES OF THE EXPECTED QUALITY OF SIGNS
M. M. Bongard et al 5 Nov. 1970 15 p refs Transl. into ENGLISH from Probl. Kibern. (Moscow), no. 20, 1968 p 151-157
(AD-717887; FTD-HT-23-475-70) Avail: NTIS CSCL 6/4

In constructing pattern recognition algorithms a certain number of characteristic features, which are selected during the learning process, are used. In selecting such features it is intended that the probability of the recognition error be minimized. Therefore, the problem of evaluating the quality of selected features arises, which is analyzed in this article. Two methods which make it possible to select the most informative features are presented. The first method is based on the selection of the class of features for a set of examples used in the learning process. It is shown that the probability of a recognition error using that feature (the quality of a feature) is a monotone function of given parameters. The second method based on the fact that during the learning process the approximate given distribution of the probabilistic characteristics of features can be constructed. The given distribution is the a priori distribution of the probabilities that the analyzed feature has a given measure and that the pattern having that feature belongs to a given class. This distribution is further used in determining the quality of selected features. GRA

N71-23317* National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
BLOOD PRESSURE MEASURING SYSTEM FOR SEPARATING AND SEPARATELY RECORDING dc SIGNAL AND AN ac SIGNAL Patent
Howard A. Vick, inventor (to NASA) Issued 16 Sep. 1969 (Filed 27 Dec. 1966) 5 p Cl. 307-260; Int. Cl. H03k5/20
(NASA-Case-XMS-06061; US-Patent-3,467,837;
US-Patent-Appl-SN-605092) Avail: US Patent Office CSCL 06B

A system for separating and separately recording a dc blood pressure signal and an ac signal representative of Korotkoff sounds is described. To record both signals the reprogramming system of the device separates the two signals, and the Korotkoff sounds are recorded on one channel and the dc pressure signal is converted to a frequency modulated signal and recorded on another channel. Thus, the inherent frequency limitations of the recorder are avoided, and an accurate record of the blood pressure signal may be made. Official Gazette of the U.S. Patent Office

N71-23337# Advisory Group for Aerospace Research and Development, Paris (France).
PRINCIPLES OF BIODYNAMICS APPLICABLE TO MANNED AEROSPACE FLIGHT PROLONGED LINEAR AND RADIAL ACCELERATION
Mar. 1971 182 p refs
(AGARDograph-150; AGARD-AG-150-71) Avail: NTIS

CONTENTS:
1. ACCELERATION TERMINOLOGY; ... TABLE OF COMPARATIVE EQUIVALENTS G. J. Pesman p 1 6 refs (See

N71-23338 12-23)

2. AN INTRODUCTION TO THE PHYSICS AND PHYSIOLOGY OF ACCELERATION S. D. Leverett, Jr. p 7-24 (See N71-23339 12-04)

3. THE DYNAMICS OF ROTATION APPLIED TO CENTRIFUGES R. E. Van Patten p 25-36 (See N71-23340 12-23)

4. A SUMMARY OF HUMAN TOLERANCE TO PROLONGED ACCELERATION A. S. Hyde and H. W. Raab p 37-56 refs (See N71-23341 12-04)

5. DESCRIPTIVE CATALOG OF AEROSPACE MEDICAL BIODYNAMICS FACILITIES IN THE UNITED STATES AND CANADA C. F. Gell (Naval Aerospace Med. Inst., Pensacola, Fla.) p 57-100 (See N71-23342 12-11)

6. BIODYNAMICS FACILITIES IN NATO EUROPEAN COUNTRIES A. Scano (Military School of Aviation Med., Rome, Italy) p 101-124 refs (See N71-23343 12-11)

7. BIODYNAMICS BIBLIOGRAPHY, 1966-1969 W. L. Jones (NASA, Washington, D. C.) p 126-196 refs (See N71-23344 12-05)

N71-23344*# National Aeronautics and Space Administration, Washington, D.C.

BIODYNAMICS BIBLIOGRAPHY, 1966 - 1969

Walton L. Jones, comp. *In* AGARD Principles of Biodynamics Applicable to Manned Aerospace Flight Prolonged Linear and Radial Acceleration Mar. 1971 p 125-196 refs (See N71-23337 12-05)

(NASA-TM-X-67138) Avail: NTIS CSCL 06B

This annotated bibliography brings together recent information, not available in earlier literature reviews, concerning biodynamics research findings. Coverage was international and provides a representative view of current research efforts. The abstracts were taken directly from the initial source documents. The bibliography is divided into six sections: (1) prolonged acceleration (linear and radial); (2) angular acceleration; (3) impact; (4) vibration; (5) combined stresses; and (6) general documents. A.L.

N71-23355# School of Aerospace Medicine, Brooks AFB, Tex.

ON SITE AUDIOMETER CALIBRATION CHECK Progress Report, 1968 - 1969

Harrell C. Sutherland, Jr. and Donald C. Gasaway Nov. 1970 15 p refs

(AD-718417; SAM-TR-70-78) Avail: NTIS CSCL 6/5

Feasibility of on-site audiometer calibration checking with portable apparatus was explored. Three Medical Equipment Repair Centers checked audiometers in their geographic areas for six months. Conclusions were that (1) the on-site audiometer calibration checks were feasible, (2) the apparatus employed was suitable, and (3) the pass-fail criterion selected was satisfactory. General calibration status of audiometers observed seemed to improve during the course of the study. Author (GRA)

N71-23376*# Techtran Corp., Glen Burnie, Md.

WATER SUPPLY OF COSMONAUTS [VODOOBESPECHENIYE KOSMONAVTOV]

N. Radchenko Washington NASA Apr. 1971 8 p Transl. into ENGLISH from Aviat. Kosmonavt. (Moscow), Sep. 1970 p 31-32

(Contract NASw-2037)

(NASA-TT-F-13634) Avail: NTIS CSCL 06K

A brief review is given of the water regeneration problem in a spacecraft and progress made toward developing a closed ecological system with a self-contained biological cycle. Experimental research performed in the U.S.S.R., including a medico-technological experiment in which three volunteers were enclosed for one year in a capsule simulating a space cabin, depending solely on regeneration for water supply, is noted. Regenerative methods developed in the U.S. are also noted. Author

N71-23393# Naval Aerospace Medical Inst., Pensacola, Fla. Research Lab.

STATE AND TRAIT ANXIETY IN STUDENT NAVAL AVIATORS

Steven F. Bucky, Charles D. Spielberger, and Ronald M. Bale 4 Dec. 1970 9 p refs

(AD-718326; NAMRL-1125; NAVMED-MF12.524.002-5001D) Avail: NTIS CSCL 5/10

Measures of state and trait anxiety were given to aviation officer candidates (AOCs) with the usual instructions as well as with instructions to answer as if each had just made his first landing on an aircraft carrier. Significant differences were sought when comparing the experimental group to college students. Author (GRA)

N71-23394# Army Medical Research Lab., Fort Knox, Ky.

THE DANCING ARABESQUE: AN UNUSUAL VISUAL EFFECT Interim Report

Isaac Behar 30 Nov. 1970 9 p ref

(AD-718027; USAMRL-913) Avail: NTIS CSCL 6/16

An usual visual effect results from moving an achromatizing lens in front of the eye while viewing an intricate multicolored pattern. This consists of a relative change in the spatial position of areas of different color. An explanation of this effect is provided. Secondary visual effects are an illusion of depth, and the production of a border in the absence of one, or the exaggeration and minimization of borders when present. Author (GRA)

N71-23399# Naval Aerospace Medical Inst., Pensacola, Fla. Research Lab.

A TECHNIQUE FOR OPTIMAL FITTING OF FLIGHT HELMETS

James W. Greene 30 Sep. 1970 13 p refs

(AD-718327; NAMRL-1118; NAVMED-MF12.524.005-7008B) Avail: NTIS CSCL 6/17

Although flight helmets selected for Navy use may possess exceptionally good noise attenuation qualities, maximum attenuation may not always be realized when the helmet is worn, particularly if the helmet does not fit. The lack of a standardized procedure for fitting flight helmets often results in a poor compromise that sacrifices noise exclusion for comfort. A procedure that involves the use of a noise source and an automatic recording audiometer has been developed as an aid in the fitting process. The noise source allows the aviator to detect acoustical leakage around his ears so that a better fit can be effected. Masked hearing threshold levels obtained with the helmets earphones may be used to demonstrate improved performance. Author (GRA)

N71-23400# Stanford Research Inst., Menlo Park, Calif.

A SURVEY OF PATTERN CLASSIFICATION AND SCENE ANALYSIS

Richard O. Duda and Peter E. Hart Jan. 1971 89 p refs

(Contract N00014-68-C-0266)

(AD-718380) Avail: NTIS CSCL 6/4

Pattern recognition is an essential part of artificial intelligence, and has been the subject of extensive research. The report gives a survey of the literature on pattern recognition. The survey is divided into two main parts, the first part devoted to statistical pattern recognition, and the second part devoted to pictorial pattern recognition. With the partial exception of waveform recognition, almost all of the work in pattern recognition falls into one or the other of these two categories. The bibliography includes more than 500 references. Author (GRA)

N71-23478# Armed Forces Radiobiology Research Inst., Bethesda, Md.

ELECTROCARDIOGRAPHY IN A RADIATION ENVIRONMENT BY THE USE OF TELEMETRY

V. A. Kieffer and C. L. Turbyfill Oct. 1970 24 p refs

(AD-718315; AFRRI-TN70-8) Avail: NTIS CSCL 6/2

Electrocardiography using an implantable radiation hardened transmitter is described. This telemetry system allows an investigator to record the electrocardiogram (ECG) of unrestrained animals in a radiation environment. The transmitter and its use in an intense radiation field are described. The selection of electrode placement, surgical implantation of the transmitter, and the transmission and reception of a signal representative of the electrical activity of the heart from which an ECG recording is made are discussed. Author (GRA)

N71-23506# Ministry of Technology, Orpington (England). Reports Centre for Science and Technology.

SELECTIVE DISSEMINATION OF INFORMATION: A SYSTEM REVIEW

S. C. Schuler *In* AGARD Sci. and Tech. Inform. Feb. 1971 22 p refs (See N71-23501 12-34)

Copyright. Avail: NTIS

Selectivity is an essential factor in the transfer of information and the Selective Dissemination of Information (SDI) is a technique for providing individual users or groups of users with announcements of a limited number of documents specifically of interest to them. For large systems, selection of relevant documents is achieved by a computer program which compares a file of bibliographic data on current reports, journals articles, etc., with the interest profile of the SDI user. The selected references can be provided to the user in card form (useful for filing) or as a computer printed listing containing the main document bibliographic data, descriptor terms and, in some cases, a short abstract. A review was made of various automated systems which have developed in North America and Europe during recent years. Some experiences of both large and small SDI systems are discussed and detailed aspects such as profile construction, cost benefits and economics, and user surveys are considered. As an alternative to printed output an outline is given of a system using on-line access to a central information store enabling the user to have selected references displayed visually at his remote console. Author

N71-23586# Massachusetts Univ., Amherst. School of Engineering.

SOME DEEP SEA VEHICLE PERSONNEL HULLS AND ENERGY STORAGE SUBSYSTEMS. PROJECT THEMIS

William E. Heronemus and George R. Kidd Nov. 1970 95 p refs

(Contract N00014-68-A-0146)

(AD-717950; THEMIS-UM-70-7) Avail: NTIS CSCL 13/10

Personnel hulls capable of carrying one, two, or more operators to 20,000 foot depths are analyzed to measure operator comfort and utility index against weight, displacement, shape, dimensions and cost. Emphasis is placed on steel hull materials. Twenty-four different configurations of either lead-acid or silver-zinc energy storage batteries are analyzed. Competitive concepts for each of these major subsystems of the deep sea vehicle are compared against each other at the subsystem level. They are compared again after integration into complete deep sea vehicles. Author (GRA)

N71-23587# Texas Univ., Austin. Electronics Research Center.

REAL TIME MATCHED FILTER DETECTION OF THE QRS COMPLEX BY REPLICA CORRELATION

Carl A. Braun, F. X. Bostick, P. C. Richardson, J. A. Welch, and F. B. Vogt 26 Jun. 1970 62 p refs

(Grant AF-AFOSR-1792-69)

(AD-718124; TR-91; AFOSR-70-1726TR) Avail: NTIS CSCL 6/2

The report describes an approach to optimum detection of each cardiac cycle from noisy electrocardiograms. A filter matched to the QRS complex of the electrocardiogram is proposed to achieve the results. It is demonstrated analytically that such a filter yields the optimum signal to noise ratio obtainable in the presence of stationary Gaussian noise. While this type of filtering is done on a digital computer, and not in real time, the advent of medium and large scale integrated circuit technology has made it feasible to implement a specific piece of hardware for this purpose. Author (GRA)

N71-23616# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.

SPEAKER-MACHINE INTERACTION IN AUTOMATIC SPEECH RECOGNITION

John I. Makhoul 15 Dec. 1970 121 p refs

(Contract DA-28-043-AMC-02536(E))

(AD-718255; TR-480) Avail: NTIS CSCL 17/2

The study examines the feasibility and limitations of speaker adaptation in improving the performance of a fixed (speaker-independent) automatic speech recognition system. A fixed vocabulary of 55 syllables is used in the recognition system, containing eleven stops and fricatives and five tense vowels. The results of the experiment on speaker adaptation, performed with 6 male and 6 female adult speakers, show that speakers can learn to change their articulations to improve recognition scores. The recognition scheme is based on the extraction of several acoustic features from the speech signal. This is accomplished by a hierarchy of decisions made on carefully selected parameters that are computed from a spectral description of the speech signal by means of a set of energoids (energy centroids), each energoid representing the center of energy concentration in a particular spectral energy band. Short-time spectra were obtained either from a bank of 36 bandpass filters covering the range 150-7025 Hz, or by directly computing the fast Fourier transform of portions of the sampled speech signal. Author (GRA)

N71-23760# Martin Marietta Corp., Orlando, Fla.

TARGET ACQUISITION STUDIES: (1) TWO DIMENSIONAL COMPARED WITH THREE DIMENSIONAL TARGETS. (2) CHANGES IN GAMMA FOR TV DISPLAYED TARGETS Final Report, 1 Jan. – 31 Dec. 1970

Frank D. Fowler, Melvin Freitag, Daniel B. Jones, and Barry King Jan. 1971 41 p refs

(Contract N00014-67-C-0340)

(AD-718382; OR-11091) Avail: NTIS CSCL 6/16

The study had two major objectives: the first was to determine whether the detection and recognition of 2-D targets are significantly different from the detection and recognition of 3D targets when target acquisition is performed using direct unaided vision and when utilizing a TV display. The second objective was to determine how differences in TV system transfer characteristics (gamma or dynamic gray scale) affect target detection and recognition capability. Trained pilots detected and recognized targets under simulated flight conditions utilizing both 2D and 3D targets with both the unaided eye and with the aid of a closed circuit TV system. Slant ranges and visual angle requirements were determined for the conditions tested. A second series of tests was run to determine the effect of changes in gamma (the gray scale transfer characteristic), on target detection and recognition capability with a TV sensor. Six trained pilots performed simulated targets detection and recognition tasks under three gamma levels. Slant ranges and visual angle requirements were determined for the conditions. Author (GRA)

N71-23751*# National Aeronautics and Space Administration, Washington, D.C.

HEART DISEASE DIAGNOSTIC TOOL

7 Apr. 1971 5 p

(NASA-News-Release-71-58) Avail: NASA Scientific and Technical Information Facility, P.O. Box 33, College Park, Md. 20740 CSCL 06B

The development of a computer animated display device is reported as a diagnostic tool for heart disease. A movie of a patients diseased heart beat permits the identification from any angle of dead spots or scar tissue in the heart wall, aneurysms, and

other malfunctions. The display can be stopped at any point of heart action and played back and forth for many cycles. The displays are derived from X-ray movies, a computer program based on heart configurations and dimensions, and a three-dimensional computer display technique. J.M.

N71-23823*# Sandia Corp., Albuquerque, N.Mex.
A PRECISELY CONTROLLED, LOW RANGE HUMIDITY SYSTEM
Daniel M. Garst and Kermit F. Lindell Nov. 1970 20 p refs
(NASA Order W-12853)
(NASA-CR-118024; SC-RR-70-775) Avail: NTIS CSCL 06F

Controlled humidity systems have been developed for studies relating the effect of relative humidity to the dry heat inactivation of microorganisms. An extension of this development in which very low relative humidity values were obtained by pressurizing the saturation portion of the system is described. Even lower values were attained by subsequently passing the air through a desiccant bed. Author

N71-23848*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
STUDY OF APPLICATIONS OF BIO-SPACE TECHNOLOGY TO PATIENT MONITORING SYSTEMS Final Report
W. A. Buck 17 Feb. 1971 343 p refs
(Contract NASw-2073)
(NASA-CR-118030) Avail: NTIS HC $6.00/MF $0.95 CSCL 06B

A study of the application of space biology developments to systems for monitoring the condition of patients is presented. The primary objective was to apply space technology to cardiovascular and pulmonary patient monitoring to improve the availability, reliability, and utility of data for medical diagnosis. The study is concerned with defining the following (1) performance requirements, (2) systems configurations, and (3) systems specifications. Author

N71-23849*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
STUDY OF APPLICATIONS OF BIOSPACE TECHNOLOGY TO PATIENT MONITORING SYSTEMS: PROGRAM PLANS AND BUDGETARY COST ESTIMATES Final Report Supplement
17 Feb. 1971 155 p refs
(Contract NASw-2073)
(NASA-CR-118035) Avail: NTIS CSCL 06B

The application of space biology techniques to the development of patient monitoring systems is discussed. Four basic physiological monitoring modules are considered for: (1) cardiac, (2) cardiovascular, (3) pulmonary, and (4) body chemistry systems. Each modular configuration includes computational capability which is provided by a mini computer. Remote displays at bedside and nurse's station provide capability for monitoring the patient's condition. Author

N71-24138*# Welson (B.) and Co., Inc., Hartford, Conn.
SUIT GLOVE ADVANCED THERMAL PROTECTION PROGRAM Final Report
1 Apr. 1971 43 p
(Contract NAS9-11231)
(NASA-CR-114974; BW-250) Avail: NTIS CSCL 06Q

Thermal conditioning techniques that allow for increased mobility, thermal performance, and greater tactility of extravehicular gloves are studied. An evaluation of all feasible techniques for active and passive heat transfer from the glove indicated two possible approaches consisting of a wire braid/tygon tubing technique and a metal bladder/tygon tubing concept for the active cooling provisions. The overglove designs included a lobster shell approach as well as the standard metal cloth design. These thermal protective assemblies were designed and fabricated for testing. The results of those tests and the conclusion are presented. Author

N71-24147* Royal Aircraft Establishment, Farnborough (England).
GARMENTS FOR CONTROLLING THE TEMPERATURE OF THE BODY Patent
Derek Rodney Burton, Bertie William Judd, and Leslie Collier, inventors (to NASA) Issued 4 Feb. 1969 (Filed 26 Oct. 1966) 3 p Great Britain Cl. priority 45709/65; Cl. 165-46; Int. Cl. F28f7/00; Int. Cl. A61f7/00; Int. Cl. F25d3/08 Sponsored by NASA
(NASA-Case-XMS-10269; US-Patent-3,425,486; US-Patent-Appl-SN-590158) Avail: US Patent Office CSCL 06Q

A garment for controlling the temperature of the human body by cooling or heating the skin is reported; it uses a network of flexible pipes for carrying a circulating liquid in a heat exchanging relationship with the body. Locating means in the form of fabric tunnels are provided which freely locate the pipes such that they can slidably move within the locating means and which restrain each pipe throughout its length in a circuitous serpentine configuration out of direct contact with the body for comfort. The pipe circuit as a whole can deform as a result of bending or twisting of the pipes with minimum restriction to deformation and stretching of the garment. Official Gazette of the U.S. Patent Office

N71-24256*# Battelle Memorial Inst., Columbus, Ohio.
CLOSED SABATIER OXYGEN-RECLAMATION SYSTEM Final Report, 1 Mar.–31 Dec. 1969
Byung C. Kim and John E. Clifford Jul. 1970 106 p refs
(NASA Order L-21229; Contract F33615-69-C-1455)
(NASA-CR-118025; AD-714062; AMRL-TR-70-8) Avail: NTIS CSCL 06K

A Closed Sabatier System for oxygen recovery from carbon dioxide was designed. Design analysis was based on a three man engineering prototype that consists of the following principal subsystems: a water vapor electrolysis/Sabatier unit, an electrochemical hydrogen stripper/Sabatier unit, a continuous catalytic methane decomposition unit, and a water vapor transfer unit. The electrochemical cell designs utilize Pd-25Ag hydrogen diffusion electrodes in tubular form containing Sabatier catalyst for integrated system operation. All components are designed for gravity independent operation with a minimum of critical rotating parts. The electrochemical units operate at about 200 C, and the methane decomposition unit at 850 C. System weight is about 90 kg with a power requirement of less than 1 kw for designed operation with 99 percent recovery of the oxygen value in the carbon dioxide feed. Author

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N71-23111*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
VAPORIZATION OF SOME GROUP IIIA METAL-METAL OXIDE SYSTEMS: MASS SPECTROMETRIC IDENTIFICATION OF INDIUM GALLIUM OXIDES (InGaO AND InGaO2) AND GALLIUM ALUMINUM OXIDE (GaAlO)
Fred J. Kohl and Carl A. Stearns Washington Apr. 1971 18 p refs
(NASA-TN-D-6318; E-6140) Avail: NTIS CSCL 07D

The vaporization of the systems In + Ga2O3 and Ga + Al2O3 was studied by the Knudsen effusion mass spectrometric

method. New gaseous molecules InGaO, InGaO2, and GaAlO were positively identified. The atomization energy of InGaO was determined to be 818 + or − 17 kJ per mole. The vaporization of the systems In + In2O3, Ga + Ga2O3, and Al + Al2O3 was reexamined. Parent molecules were identified and their relative intensities were measured. It was shown that the only vaporization products significant with respect to effusive weight loss are the atomic species and M2O-type molecules. Author

N71-23130# Michigan State Univ., East Lansing. Dept. of Physics.
DEPENDENCE OF THE HELIUM 2 FILM TRANSFER RATE ON PRESSURE HEAD, FILM HEIGHT, AND SUBSTRATE
Carl James Duthler (Ph.D. Thesis) 1970 81 p refs Sponsored by AEC
(COO-1574-17) Avail: NTIS

Helium film transfer rates, sigma, were measured as a function of level difference, z, and height, h, to the beaker rim, for filling clean glass and neon-coated beakers. The dependence of the critical velocity on film thickness, is determined. A 16% decrease is observed in sigma going from a clean glass substrate to a neon-coated substrate in the same apparatus. This result is in reasonable agreement with the calculated helium film thickness for a neon substrate of 2.3h to the −1/3 power × .000001 cm. Author (NSA)

N71-23167*# Allied Chemical Corp., Morristown, N.J.
OXYGEN DIFLUORIDE RESEARCH STUDY Final Report, Jun. 1963–Sep. 1965
Ralph B. Jackson Dec. 1970 186 p refs
(Contract NAS3-2564)
(NASA-CR-72380) Avail: NTIS CSCL 07D

Decontaminants for the control of oxygen difluoride (OF2) spills were evaluated. Dilute aqueous solutions of ammonia were found to be the most effective decontaminants. The compatibility of 40 plastic and elastomeric materials with gaseous and liquid OF2 under static conditions was investigated. The most resistant materials were found to be tetrafluoroethylene, chlorotrifluoroethylene, and fluorinated ethylene-propylene polymers. The materials found to be most compatible in the static evaluation were selected for testing under dynamic OF2 conditions. An investigation of the phenomenon of explosive burnout, was conducted. Instant and complete decomposition of OF2 gas, initiated by thermal shock, failed to produce detonation or burnout. Author

N71-23168*# Allied Chemical Corp., Morristown, N.J.
OXYGEN DIFLUORIDE RESEARCH STUDY Final Report
Ralph B. Jackson Dec. 1970 189 p refs
(Contract NAS3-6298)
(NASA-CR-72357) Avail: NTIS CSCL 07D

The compatibility of several materials to oxygen difluoride under dynamic conditions was investigated. Metal test orifices were successfully exposed to liquid OF2 flows at pressures to 1500 psig and to gaseous OF2 at sonic velocity. Plastic orifices were tested and found to be compatible to liquid OF2 flows at pressures to 500 psig. A metal ignition study was conducted. Wires were heated electrically in an OF2 atmosphere and the ignition temperatures were calculated from resistivity-temperature data. Author

N71-23172*# Applied Electrochemistry, Inc., Sunnyvale, Calif.
DEVELOPMENT OF A CO2-H2O SOLID OXIDE ELECTROLYSIS SYSTEM Annual Report, 1 Apr.–31 Dec. 1970
J. Weissbart and W. H. Smart Mar. 1970 92 p refs
(Contract NAS2-4843)
(NASA-CR-114295; AR-3) Avail: NTIS CSCL 07D

The advances made in the development of CO2-H2O electrolyzer modules for the generation of oxygen for life-support systems are described. Significant improvements were made with respect to: (1) ease of fabrication, (2) duration of operation with production of breathable oxygen, and (3) increase of CO2 conversion per pass to CO for better utilization of the CO in the disproportionation reactor. Improvements were incorporated stepwise in eight electrolyzer modules which were constructed and operated with an output of breathable oxygen of > 99% purity, and CO2 conversion per pass averaging 50 percent. The modules ranged in number of cells from two to sixteen, total electrode area of 40 to 320 sq cm, total output of oxygen at 100% faradaic efficiency from 4 to 32 amperes, and CO2 content in the oxygen of <1 percent. The operating period ranged from 11 to 101 days. Author

N71-23209*# Cornell Univ., Ithaca, N.Y. Center for Radiophysics and Space Research.
EXOBIOLOGY AND THE ORIGIN OF LIFE Semiannual Progress Report
15 Mar. 1971 7 p refs
(Grant NGR-33-010-101)
(NASA-CR-117896; CRSR-433) Avail: NTIS CSCL 07D

A mixture of gases roughly simulating the primitive terrestrial atmosphere was subjected to shock heating followed by a rapid thermal quench. Calculations suggest that rapid quenching bypasses the usual thermochemical barrier. The product of energy flux and efficiency implies the unexpected conclusion that shocks occurring on atmospheric entry of cometary meteors and micrometeorites and from thunder may have been the principal energy sources for prebiological organic synthesis on the primitive earth. Author

N71-23230* Battelle Memorial Inst., Columbus, Ohio.
PROCESS FOR PREPARATION OF DIANILINOSILANES Patent
William R. Dunnavant and Richard A. Markle, inventors (to NASA) Issued 18 Mar. 1969 (Filed 26 Aug. 1966) 3 p Cl. 260-448.2; Int. Cl. C07f7/10, 7/12; Int. Cl. C07d31/20 Sponsored by NASA
(NASA-Case-XMF-06409; US-Patent-3,433,818; US-Patent-Appl-SN-575930) Avail: US Patent Office CSCL 07D

Dianilinosilanes are prepared by reacting a dichlorosilane with aniline in the presence of 2,4,6-trimethyl pyridine (s-collidine) in an organic solvent. By-product aniline hydrochloride is removed from the reaction mixture by precipitation as a hydrochloride salt of the s-collidine. Contaminating side-reactions are avoided, and a high-purity product suitable for polymer synthesis is obtained. Official Gazette of the U.S. Patent Office.

N71-23315 Du Pont de Nemours (E. I.) and Co., Wilmington, Del.
AKROFLEX AZ: A SAFE PROCESSING ANTIOZONANT
D. H. Geschwind and R. S. Tobey 1971 11 p
Copyright. Avail: Issuing Activity

Akroflex AZ is a hindered diaryl p-phenylenediamine antiozonant. In Neoprene it imparts better ozone resistance and causes less bin scorch than any other commercial antiozonant of the p-phenylenediamine class. It is also an effective, safe processing antiozonant for SBR and other polymers. Author

N71-23367*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THERMALLY STABLE POLYIMIDES FROM SOLUTIONS OF MONOMERIC REACTANTS
T. T. Serafini, P. Delvigs, and G. R. Lightsey [1971] 13 p refs Presented at 5th St. Louis Symp. on Advanced Composites, St. Louis, 6–7 Apr. 1971; sponsored by Monsanto Co. and Wash. Univ. ARPA res. proj.

(NASA-TM-X-67803) Avail: NTIS CSCL 07D

A method to prepare thermally stable resin fiber reinforced composites using solutions of appropriate monomers is described. Solutions containing a dimethyl ester of an aryl tetracarboxylic acid, the monomethyl ester of nadic acid and an aryl diamine were used to impregnate graphite fibers. Composites fabricated from these prepregs exhibited excellent thermo-oxidative stability and retention of mechanical properties at 600 F. These results compare favorably to those obtained from composites made from amide acid prepolymers capped with reactive alicyclic rings. Monomeric solutions provide excellent shelf life and improved solubility compared to amide acid prepolymer solutions. Author

N71-23432# Royal Aircraft Establishment, Farnborough (England).
ANALYSIS WITH A PYROLYSIS-GAS CHROMATOGRAPH-MASS SPECTROMETER SYSTEM. POLYIMIDES
R. I. Butt and J. L. Cotter Oct. 1970 24 p refs
(RAE-TR-70177) Copyright. Avail: NTIS

A pyrolysis-gas chromatograph-mass spectrometer system has been used to analyse the products from the pyrolysis of a polyimide and certain perfluoro alkylene-linked polyimides in an inert atmosphere. The major primary degradation products were carbon monoxide and carbon dioxide; in addition large amounts of silicon tetrafluoride were produced, as a secondary product, by pyrolysis of the fluorine-containing materials. Thermal decomposition schemes consistent with the formation of these products are proposed. Results obtained with model compounds suggest that perfluoro alkylene groups have a more pronounced effect on the electron-impact behavior of the imide ring than on its thermal breakdown. Author (ESRO)

N71-23479# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
PHYSICOCHEMICAL MEASUREMENTS OF METAL-BETA-DIKETONATES. 1: VAPOR PRESSURES. 2: SOLUTION THERMODYNAMICS STUDIES BY GAS-LIQUID CHROMATOGRAPHY Final Report, Jul. 1967 - Dec. 1969
Wayne R. Wolf, Robert E. Sievers, and Glenn H. Brown (Kent State Univ.) Nov. 1970 162 p refs
(AD-718429; ARL-70-0267) Avail: NTIS CSCL 7/2

The detailed physicochemical behavior of Metal-beta-diketonate complexes within gas-liquid chromatographic (GLC) columns was studied. The vapor pressures and heats of vaporization of chelates of several metals with the bidentate ligands hexafluoroacetylaetone (hfa) and heptafluorodimethyloctanedione (fod) have been measured. These results show the hfa chelates to be more volatile than the fod chelates. GLC retention data were collected for ten different chelates in three liquid phases and the heats of solution calculated for each system from the temperature dependence of the specific retention volume. Activity coefficients were calculated at 140C, 150C and 160C for each system and the excess enthalpy of mixing determined. The octahedral tris chelates showed large positive deviations from Raoults Law in hydrocarbon stationary phases. In a fluorinated siloxane phase these chelates showed much lower positive deviations and in many cases almost ideal solution behavior. Square planar bis chelates showed negative deviations from Raoults' Law in both hydrocarbon and siloxane phases. Author (GRA)

N71-23499* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DECONTAMINATION OF PETROLEUM PRODUCTS Patent
James R. Mosier, inventor (to NASA) Issued 16 Jul. 1968 (Filed 18 May 1965) 2 p Cl. 44-77 Sponsored by NASA
(NASA-Case-XNP-03835; US-Patent-3,393,059; US-Patent-Appl-SN-456874) Avail: US Patent Office CSCL 07C

A description is given of a means and method of effectively controlling bacteria growth in petroleum products, as well as trapping other impurities such as water and solid particles which normally settle to the bottom of stored petroleum products, by the use of a small effective amount of honey.
Official Gazette of the U.S. Patent Office

N71-23500* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DICYANOACETYLENE POLYMERS Patent
Alan Rembaum and Arnold W. Henry, inventors (to NASA) Issued 31 Dec. 1968 (Filed 3 Sep. 1965) 2 p Cl. 260-85.5 Sponsored by NASA
(NASA-Case-XNP-03250; US-Patent-3,419,537; US-Patent-Appl-SN-485058) Avail: US Patent Office CSCL 07C

Copolymers of dicyanoacetylene and vinylidene compounds are made by mixing the two materials, preferably in a solvent such as tetrahydrofuran in the presence of an initiator which preferably is a free radical initiator such as azo-bis-isobutyronitrile. The mixture is preferably deaerated then sealed at subatmospheric pressure and heated between about 40 and 70 C. for 10 to 30 hours. Official Gazette of the U.S. Patent Office

N71-23519# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CHEMISTRY OF HYDRIDES [KHIMIYA GIDRIDOV]
A. F. Zhigach et al 23 Dec. 1970 776 p refs Transl. into ENGLISH from the Russian
(AD-718179; FTD-MT-24-128-70) Avail: NTIS HC $9.00/MF $0.95 CSCL 7/2

The monograph contains a description of physico-chemical and chemical properties of compounds of elements with hydrogen and methods for obtaining them, purification, isolation, and analysis. Considerable attention is alloted to the application of hydrides. Extensive material of a reference nature is presented. There are 646 references. GRA

N71-23520# California Univ., Livermore. Lawrence Radiation Lab.
DETERMINATION OF BORON IN BORATES, BORON HYDRIDES, ORGANO-BORON COMPOUNDS, ELEMENTAL BORON AND REFRACTORY BORIDES
L. P. Rigdon and M. C. Waggoner 8 Oct. 1970 10 p refs Sponsored by AEC
(UCRL-50948; TID-4500) Avail: NTIS

Procedures for determining boron in a variety of materials in which boron is a major constituent are outlined. Samples are dissolved in aqueous sodium peroxide solution, sodium carbonate fusion, dehydrated H_2SO_4-HNO_3 or by pyrohydrolysis. Interferences are removed by complexation, precipitation, volatization or ion exchange columns, and the boron is determined by titrating a boro-mannitol complex with sodium hydroxide. Methods of standardizing the titrant are discussed, and a list of materials analyzed with the preferred treatment procedure is presented.
Author (NSA)

N71-23526# Minnesota Univ., Minneapolis. Dept. of Chemical Engineering.
KINETICS OF METHYLENE AND HYDROXYL RADICAL REACTIONS Technical Progress Report
Robert W. Carr, Jr. [1970] 12 p refs
(Contract AT(11-1)-2026)
(COO-2026-4) Avail: NTIS

Transport equations for convective flow, diffusion, and chemical reaction in a steady flow system were solved, and the results were presented in the form of a dimensionless average concentration (averaged in the way that is experimentally done by the application of various detection techniques) versus dimensionless distance from the point of mixing of the reactants. Solutions for first and second order kinetics were obtained, and the method for using the dimensionless plots to deduce accurate rate constant values was given. Author

N71-23527* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ANALYTICAL TEST APPARATUS AND METHOD FOR DETERMINING OXIDE CONTENT OF ALKALI METAL Patent

Judson W. Graab, Louis Rosenblum, William E. Maple, William A. Dupraw, and Randall F. Gahn, inventors (to NASA) Issued 14 Oct. 1969 (Filed 25 Jan. 1965) 4 p Cl. 23-230; Int. Cl. G01n31/16 (NASA-Case-XLE-01997; US-Patent-3,472,625; US-Patent-Appl-SN-427990) Avail: US Patent Office CSCL 07D

A method and apparatus for determining the oxygen content in an alkali liquid metal with greater accuracy are described. Means under vacuum is provided for cutting off and removing a first portion of the solidified sample which may contain contaminants, then cutting off a second portion of the sample and transferring it under vacuum to an extraction chamber which is then sealed off from the extrusion chamber by a valve. Mercury is then introduced to the extraction chamber to form an amalgam. A magnetic ball check valve seats in a narrowed portion of the extraction chamber and is activated by a glass covered magnetic bar to control the flow of amalgam into a flask disposed below extraction chamber in an airtight communication. The weight of the alkali metal and its oxide is then determined by titration.

Official Gazette of the U.S. Patent Office

N71-23574# Explosives Research and Development Establishment, Waltham Abbey (England).

SOME SOLVATES OF BSX

W. E. Batty, J. A. Bell, Patricia J. Clements, D. F. Debenham, J. R. C. Duke et al Feb. 1970 21 p refs

(ERDE-TN-18) Avail: NTIS

Solvates have been obtained from BSX using a variety of solvents; polymorphs are probably formed using benzene and its homologues. The formation of new phases was established by X-ray powder diffraction photography and/or optical microscopy. The solvates were not sufficiently stable for infrared analyses or for thermogravimetric measurements to be carried out.

Author (ESRO)

N71-23588# Tyco Labs., Inc., Waltham, Mass.

PURIFICATION AND ANALYSIS OF ORGANIC NONAQUEOUS SOLVENTS Final Report, 1 Oct. 1967–30 Sep. 1970

James N. Butler, Raymond J. Jasinski, David R. Cogley, H. Lloyd Jones, John C. Synnott et al 29 Dec. 1970 252 p refs

(Contract F19628-68-C-0052)

(AD-718109; C-742; AFCRL-70-0605) Avail: NTIS CSCL 7/3

In order to make possible a rigorous program of research and development of high energy battery systems based on aprotic organic electrolytes and lithium anodes, a literature survey and a number of experimental studies have been conducted on the purification and analysis of relevant solvents: acetonitrile, butyrolactone, dimethyl sulfoxide, dimethyl formamide, formamide, hexamethyl phosphoramide, N-methyl pyrrolidone, propylene carbonate, and tetrahydrofuran. In all cases, methods have been developed (where not already available) for purification to a level of less than 10 ppm water or organic impurities, and for analysis of the solvents at that purity level. Stability of the pure solvents, particularly in contact with lithium electrodes, has been examined critically. For the solvents propylene carbonate, dimethyl sulfoxide, dimethyl formamide, and hexamethyl phosphoramide, the exchange current of a solid lithium electrode has been determined and the effect of added water on this kinetic parameter has been studied.

Author (GRA)

N71-23722 Texas A&M Univ. College Station.

EXCESS ULTRASONIC ATTENUATION AND VOLUME VISCOSITY IN LIQUID METHANE

James Robert Singer (Ph.D. Thesis) 1969 70 p

Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 70-9721

Ultrasonic attenuation in liquid methane was measured at temperatures between 94 K and 146 K with pressures to 87 kg/sq cm. The measured attenuation greatly exceeds that accounted for by the dissipation due to shear viscosity and thermal conductivity. This shows a considerable need for the volume viscosity in the attenuation equation of Navier-Stokes. The excess attenuation observed is attributed to the intrinsic volume visocity in liquid methane. It is not believed that the internal degrees of freedom in methane are contributing an extra term to the measured attenuation as if by some relaxation mechanism. Dissert. Abstr.

N71-23756# National Aeronautical Establishment, Ottawa (Ontario).

AN APPARATUS AND PROCEDURE FOR DETERMINING CROSS-LINKING TIME AND EXOTHERMIC TEMPERATURE OF REACTING PLASTIC COMPOSITIONS

P. D. McLean and R. F. Scott Natl. Res. Council Aug. 1970 29 p refs

(NRC-11849; MS-130) Avail: NTIS

An apparatus and procedure is described for determining cross linking time and exothermic temperatures of reacting plastic compositions. The apparatus consists essentially of an oil bath, insulating flask, double vessels, and temperature-time recording system.

Author

N71-23782# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.

AQUEOUS DEGRADATION OF POLYIMIDES

R. De Iasi and J. Russell Apr. 1971 27 p refs

(RM-504) Avail: NTIS

The effect of an aqueous environment on the tensile properties of polimide Kapton film has been investigated. Immersion of specimens in distilled water at 25 to 100 C for time periods ranging from one hour to several hundred hours resulted in a decrease in the ultimate tensile strength of the polymer from 23 Ksi to approximately 14 Ksi, and a corresponding decrease in elongation to failure from 38 percent to approximately 5 percent. The kinetics of this decrease in mechanical properties are second order and yield an activation energy of approximately 15.6 Kcal/mole. The reaction is slightly dependent on pH in the range 2.0 to 12.0, but is highly dependent on the pH in the range 0.4 to 2.0. The decrease in mechanical properties at pH 2.0 to 8.0 appears to be due to hydrolysis of either uncyclized amic acid linkages or diamide functional groups present in the polyimide, whereas that at pH below 2.0 is probably the result of hydrolysis of both imide and amide bonds.

Author

N71-23783# Pennsylvania State Univ., University Park. Ionosphere Research Lab.

THE MERCURY PHOTOSENSITIZED DECOMPOSITION OF N2O IN THE PRESENCE OF MIXTURES OF CO AND CH4

Julian Heicklen and R. Simonaitis 31 Mar. 1971 22 p refs

(Grant NSF GA-12385)

(SR-369) Avail: Issuing Activity

The mercury photosensitized decomposition of N2O in the presence of CO-CH4 mixtures was studied at 548 K. From the competition between CO and CH4 for O(3P), the ratio k sub 1/k sub 2 was found to be 2.0, where reactions 1 and 2 are: O(3P) + CO yields CO 2; and O(3P) + CH4 yields CH3 + HO. Furthermore the HO radical produced in reaction 2 can react with either CO or CH4. An approximate value for k sub 4/k sub 3 = 1.0 was obtained. A reexamination of the determination of K sub 2 indicated that its value is 2 to 10 times smaller than previously reported.

Author

N71-23784# Washington Univ., St. Louis, Mo. Thermodynamics Research Lab.

CORRELATION AND PREDICTION OF EXCESS PROPERTIES FOR HYDROCARBON LIQUID MIXTURES

Wallace I. -C. Yuan, David A. Palmer, and Buford D. Smith Jan. 1971 34 p refs Submitted for publication
Avail: NTIS

A correlation framework based on the modified conformal solution theory has been established for the excess thermodynamic properties of mixtures boiling in the C6-C7 hydrocarbon range. The correlation contains only two binary constants but two temperature correlation constants are required for each binary constant. Once the four binary temperature correlation constants have been established from limited mixture data, the correlation accurately predicts the phase equilibria, the heat-of-mixing, and the volume change of mixing over relatively wide temperature ranges. Author

N71-23785# Washington Univ., St. Louis, Mo. Thermodynamics Research Lab.
CORRELATION OF A PARTIALLY MISCIBLE TERNARY SYSTEM WITH CONFORMAL SOLUTION THEORY
David A. Palmer, Wallace I. - C. Yuan, and Buford D. Smith Apr. 1971 29 p refs Submitted for publication
(Grant NSF GK-1971)
Avail: Issuing Activity

Extensive G sup E, H sup E, and V sup E data for the partially miscible acetonitrile + benzene + n-heptane system have been correlated successfully with a formalism based on conformal solution theory. The G sup E correlation was superior to that obtained with the three parameter NRTL equation. The general weighting function approach suggested in 1964 by Wheeler was used. The radius of gyration was used to represent size shape effects. Pair weighting parameters were determined for those molecular pairs with identifiable special interactions. A general correlation based on this approach may be feasible for mixtures containing polar molecules. Author

N71-24022*# Miami Univ., Coral Gables, Fla. Inst. of Molecular Evolution.
[MOLECULAR EVOLUTION RESEARCH] Annual Report
30 Sep. 1970 32 p refs
(Grant NGR-10-007-008)
(NASA-CR-118031; AR-6) Avail: NTIS CSCL 07C

Simple organic (carbon) compounds have been found in interstellar matter in the galaxy. These have been identified by microwave spectroscopy as formaldehyde, ammonia, and water. Traces of amino acids had been detected after heating formaldehyde and ammonia mixtures. Since glycine, alanine, aspartic acid, glutamic acid, serine, and threonine are found in such experiments carried out at 185 deg, and the entire sequence of cosmic reactants yielding amino acids yielding proteins (proteinoids) yielding primitive cells (proteinoid microspheres) is demonstrated to occur, from intermediates which are here now, under conditions which are widespread on the contemporary Earth. These conditions include temperatures lower than 200 deg. This theory of the evolution of molecules is thus on an unexpectedly rigorous basis, inasmuch as reactants and conditions for all steps (except precursors for some of the amino acids) exist now. Author

N71-24062# Kentucky Univ., Lexington. Dept. of Electrical Engineering.
A LASER RAMAN STUDY OF TWO HALIDES OF SULFUR Final Report
Eugene B. Bradley Apr. 1971 61 p refs *Its* UKY Bull. 95
(Grant NSF GK-1576) Avail: Issuing Activity

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3. FURTHER INVESTIGATIONS OF THE CHARACTERISTICS OF THE 992 cm/1 RAMAN BAND OF BENZENE p 10 - 11 refs (See N71-24065 12-06)

4. A VIBRATIONAL ANALYSIS OF S2Br2 AND S2Cl2 p 12 - 17 refs (See N71-124066 12-06)

5. INVESTIGATIONS OF THE RAMAN AND INFRARED SPECTRA OF THIOPHOSGENE AND POLYMERIC SPECIES p 18 - 25 refs (See N71-24067 12-06)

6. SLIT FUNCTIONS CORRECTIONS APPLIED TO LASER EXCITED RAMAN BANDS OF LIQUIDS p 26 - 34 refs (See N71-24068 12-16)

7. CALCULATIONS OF RAMAN LINE INTENSITIES, STANDARDS INTENSITIES, AND SCATTERING CROSS SECTIONS FOR S2Cl2 AND S2Br2 p 35 - 51 refs (See N71-24069 12-06)

N71-24063# Kentucky Univ., Lexington. Dept. of Electrical Engineering.
NEW MEASUREMENTS OF THE INFRARED AND THE RAMAN SPECTRUM OF S2Cl2
In its A Laser Raman Study of Two Halides of Sulfur Apr. 1971 p 3 - 6 refs (See N71-24062 12-06)
Avail: Issuing Activity

The Raman spectrum of S2Cl2 has been excited with a 6-mW He-Ne laser, 6328 A, and new depolarization ratios of the Raman bands have been obtained. The Raman band at 449/cm is shown to be two bands corresponding to two fundamentals, one of Type A and another Type of B, at 446/cm and 434/cm, respectively. The Raman band at 102/cm corresponding to the torsional mode is found to be polarized in disagreement with earlier investigations; the torsional model is far infrared active at 106/cm. Three infrared active fundamentals and six overtones were observed in the 3000/400/cm region. One of these overtones at 1340/cm has not been reported previously. The Raman and infrared data have been correlated with the right-angle configuration of C2 symmetry, and thermodynamic properties have been calculated for the liquid state using the harmonic oscillator approximation. Author

N71-24064# Kentucky Univ., Lexington. Dept. of Electrical Engineering.
NEW MEASUREMENTS OF THE RAMAN AND THE FAR INFRARED SPECTRUM OF S2Br2
In its A Laser Raman Study of Two Halides of Sulfur Apr. 1971 p 7 - 10 refs (See N71-24062 12-06)
Avail: Issuing Activity

The Raman spectrum of S2Br2 has been excited with a 6-mW He-Ne laser operating at 632A, and new depolarization ratios of the Raman bands have been obtained. The Raman band at 68/cm corresponding to the torsional mode is found to be polarized in disagreement with an earlier Raman investigation; the torsional mode is far infrared active at 70/cm. The Raman band at 534/cm is found to be polarized and of type A in contrast to earlier work in which this band was found to be depolarized and of type B. The Raman band at 304/cm is found to be depolarized and of type B whereas in an earlier investigation the band was reported as polarized and of type A. The new Raman and infrared data have been correlated with the right angle configuration of C2 symmetry and new assignments have been made. Six coincident Raman- and infrared-active fundamentals are now known. Author

N71-24065# Kentucky Univ., Lexington. Dept. of Electrical Engineering.
FURTHER INVESTIGATIONS OF THE CHARACTERISTICS OF THE 992 cm/1 RAMAN BAND OF BENZENE
In its A Laser Raman Study of Two Halides of Sulfur Apr. 1971 p 10 - 11 refs (See N71-24062 12-06)
Avail: Issuing Activity

Small Raman shifts and broadenings are partly due to a change in the polarization characteristics of the band wings and

are not necessarily related to an actual band shift. Solutions of S2Br2 and S2Cl2 in benzene produce small solvent shifts and distortions in the benzene Raman band at 992/cm. These solutions do not indicate higher solute-solvent effects at increased concentrations; hence there is some doubt as to whether the small perturbing effects on the 992/cm Raman band of benzene reported elsewhere are the effects of intermolecular interactions. Author

N71-24066# Kentucky Univ., Lexington. Dept. of Electrical Engineering.
A VIBRATIONAL ANALYSIS OF S2Br2 AND S2Cl2
In its A Laser Raman Study of Two Halides of Sulfur Apr. 1971 p 12-17 refs (See N71-24062 12-06)
Avail: Issuing Activity

Recent investigations of the Raman and infrared spectra of S2Br2 and S2Cl2 have reported new polarization data and the observation of previously unreported fundamentals. A normal coordinate analysis investigates the transferability of the valence force field for these molecules, and the results of these calculations are reported in terms of potential energy distributions, vibrational mean amplitudes, Cartesian atom displacements, and Coriolis coupling coefficients. The respective spectra are discussed in light of these data, and a value for the S-S force constant is reported. Author

N71-24067# Kentucky Univ., Lexington. Dept. of Electrical Engineering.
INVESTIGATIONS OF THE RAMAN AND INFRARED SPECTRA OF THIOPHOSGENE AND POLYMERIC SPECIES
In its A Laser Raman Study of Two Halides of Sulfur Apr. 1971 p 18-25 refs (See N71-24062 12-06)
Avail: Issuing Activity

The Raman and infrared spectra of thiophosgene and its dimer have been reinvestigated and assignments based on new data and a normal coordinate analysis of the monomer are presented. The spectra obtained in gas, liquid, and solid phases are compared and two polymeric species and their spectra are discussed. A description of the fundamentals of thiophosgene is presented in terms of atom displacements, potential energy distributions, and Coriolis coupling coefficients. The transferability of the valence force field between thiophosgene and phosgene is demonstrated. Author

N71-24069# Kentucky Univ., Lexington. Dept. of Electrical Engineering.
CALCULATIONS OF RAMAN LINE INTENSITIES, STANDARD INTENSITIES, AND SCATTERING CROSS SECTIONS FOR S2Cl2 AND S2Br2
In its Laser Raman Study of Two Halides of Sulfur Apr. 1971 p 35-51 refs (See N71-24062 12-06)
Avail: Issuing Activity

The computer program used to perform calculations for sulfur monochloride and sulfur monobromide was checked for initial errors by performing the same calculations for the 992/cm and the 1178/cm lines of the normal Raman spectrum of benzene. Experimental values of the standard intensity, degree of depolarization, and forward scattering cross section are given for both of these Raman lines. Author

N71-24291 National Lending Library for Science and Technology, Boston Spa (England).
THE ROLE OF SURFACE ACTIVE AGENTS IN MASS TRANSFER [ROLYA NA POVURKHNOETNOAKTIVNITE VESHCHESTVA PRI MASOOBMENA]
O. Elenkov et al Mar. 1971 24 p refs Transl. into ENGLISH from Izv. Otd. Khim. Nauki, Bulg. Akad. Nauk. (Sofia), v. 2, no. 3, 1969 p 537-548
(NLL-RTS-6328) Avail: Natl. Lending Library, Boston Spa, Engl.: £2.30; 8 NLL photocopy coupons

The effects of surface active agents on the hydrodynamics and mass transfer of gas to liquid and of liquid to liquid systems was studied on discrete bubbles, drops, streams, and film flows. The results indicate that many previously reported results are due to impure reagents or contact with rubber or synthetics causing contamination of the system, especially in the case of extraction. Author

N71-24308# Washington Univ., St. Louis, Mo. Thermodynamics Research Lab.
CONFORMAL SOLUTION CORRELATION FOR SIMPLE LIQUIDS
J. J. Houng and Buford D. Smith Jan. 1970 34 p refs Submitted for publication
(Grant NSF GK-1971)
Avail: Issuing Activity

An initial version of a broader correlation for mixtures of simple liquids based on the conformal solution formalism is presented. The correlation includes only those substances with critical temperatures between about 151.1 K (argon) on the low end and about 305.3 K (ethane) on the high end. The conformal solution formalism appears to provide a suitable mathematical framework for a good correlation and a prediction scheme. The correlation does not relate the Gibbs excess free energy F(E) and the excess enthalpy H(E) exactly; the H(E) values predicted from F(E) and the excess volume V(E) measurements are usually 1 or 2 cal/mole too low, presumably due to omission of temperature derivatives. The determination of a pair of constants for each binary from F(E) and V(E), or H(E) and V(E), measurements at a single temperature permits what appear to be reasonably accurate predictions of F(E) up to the critical temperature. The binary constants evidently can be assumed to be constant over a 30 or 40 C range. The correlation appears to be capable of predicting ternary data from binary constants. Author

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N71-23221# Naval Research Lab., Washington, D.C.
A POSTDETECTION METHOD OF MEASURING PREDETECTION RF SIGNAL-TO-NOISE RATIO Final Report
Lamont J. Blake 7 Jan. 1971 21 p refs
(AD-718813; NRL-7233) Avail: NTIS CSCL 14/2

A method of determining the predetection signal-to-noise power ratio in a receiving system by measurement of average postdetection signal-plus-noise and noise-only voltages (DC output of the detector) is described. The principle has actually been known for many years, but does not seem to be well known or widely used, possibly because of some associated computational difficulties. Some digital-computer tabulated results are presented which remove these difficulties, and measurement techniques are discussed. The calculation of expected signal-to-noise ratio for radar and radio systems is briefly reviewed. Author (GRA)

N71-23274# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ELECTRONICS IN BELORUSSIA
A. A. Smirnov 16 Nov. 1970 13 p Transl. into ENGLISH from Radio (Moscow), no. 6, 1970 p 3-4
(AD-717898; FTD-HT-23-764-70) Avail: NTIS CSCL 17/2

The article reviews briefly the accomplishments of Belorussian workers in the fields of radio building, broadcasting, and training. The contribution of DOSAAF and the inspiration of radio sports are discussed. Author (GRA)

N71-23308# Control Data Corp., East Boston, Mass. Space and Defense Systems Div.
ADVANCED DEVELOPMENT MODEL RECEIVER, 33 TO 140 GHz Final Report, 1 Dec. 1964 – 26 Nov. 1969
Orville M. Giddings Ft. Monmouth, N.J. ECOM 13 Feb. 1970 53 p ref
(Contract DA-28-043-AMC-00449-(E))
(AD-718799; ECOM-5318) Avail: NTIS CSCL 17/4

A sweeping receiver system was developed which provides a visual display of received signals in the frequency range from 33 to 140 GHz and frequency markers. Continuous coverage is provided in four bands: 33 to 50 GHz, 63 to 90 GHz, 100 to 120 GHz and 120 to 140 GHz. The system consists of: (1) a remote control and display console, (2) an R.F. assembly, (3) four interchangeable R.F. Heads which include antennas and which attach to the R.F. Assembly, (4) interconnecting cables which allow up to 30 feet of separation between the R.F. Assembly and the Display Console.
Author (GRA)

N71-23360# Signals Research and Development Establishment, Christchurch (England).
BANDWIDTH COMPRESSION BY SIGNAL DISTORTION
D. E. Hampton Nov. 1970 23 p
(SRDE-70051) Avail: NTIS

A theoretical study is made of the relationship between the signal bandwidths at the input and the output of a memoryless nonlinear device and it is shown that when the modulus of the input signal amplitude has an exponential probability density a 30% reduction in bandwidth can be achieved at the expense of a considerable increase in the dynamic range of the output signal and loss in signal to noise ratio. Further, it is not possible to obtain more than this bandwidth reduction by such nonlinear processing.
Author (ESRO)

N71-23363# Royal Aircraft Establishment, Farnborough (England).
A SIMPLE FM PULSE COMPRESSION SYSTEM FOR COMMUNICATIONS
M. L. Rance Jun. 1970 35 p refs
(RAE-TR-70110) Copyright. Avail: NTIS

A novel FM pulse compression system is presented together with its important spectrum and signal properties. Its advantages over existing proposals in terms of complexity are explained and a full comparison is made between the systems.
Author (ESRO)

N71-23372# American Nucleonics Corp., Woodland Hills, Calif.
EFFECT OF IONOSPHERIC DEPRESSION ON LONG RANGE COMMUNICATIONS AT VERY LOW FREQUENCIES, PHASE 5 Final Report, Jan. – Nov. 1970
Kenneth Schwartz Nov. 1970 77 p refs
(Contract DA-49-146-XZ-533)
(AD-718391; ANC-32-R-4-D; DASA-2588) Avail: NTIS CSCL 20/14

The report contains detailed information on two major experimental programs, propagation over a polar ice cap and propagation across a day night transition, plus two lesser programs, a set of test data for comparison with an experimental version of the VLF propagation prediction code being developed at NEL - San Diego, and a brief investigation into the propagation behavior of the optimum mode corresponding to a vertical magnetic field with an extremely low range-attenuation rate.
Author (GRA)

N71-23380# Naval Submarine Medical Center, Groton, Conn. Submarine Medical Research Lab.
PROBLEMS OF VOICE COMMUNICATION IN THE NAVY. REGULATION OF VOCAL INTENSITY AT LOW FUNDAMENTAL FREQUENCIES Interim Report
Thomas Murry 24 Aug. 1970 13 p refs
(AD-718857; SMRL-639; NAVMED-MF12.524.004-9011D) Avail: NTIS CSCL 17/2

Extremely low frequency phonation (often called glottal or vocal fry) provides a research tool for understanding certain vocal distortions which may be present in conditions in which the Navy swimmer or diver operates. This study investigated the regulation of intensity at very low frequency phonation. Subjects produced various frequency intensity combinations of vocal fry; the samples were recorded and analyzed. The results indicate that at low fundamental frequencies intensity is relatively low compared to modal phonation (conversational speech). Furthermore, there appeared to be an interdependence between changes in frequency and intensity. The results provide preliminary data for investigations of phonation as it occurs in environments which may effect vocal output, that is, in increased ambient pressure, the normal environment of Navy swimmers and divers.
Author (GRA)

N71-23405* Westinghouse Electric Corp., Pittsburgh, Pa.
FREQUENCY SHIFT KEYING APPARATUS Patent
David P. Mikszan, inventor (to NASA) Issued 17 Dec. 1968 (Filed 11 Feb. 1965) 5 p Cl. 325-163 Sponsored by NASA
(NASA-Case-XGS-01537; US-Patent-3,417,332;
US-Patent-Appl-SN-432026) Avail: US Patent Office CSCL 17B

Apparatus for the generation of frequency shifted output signals having no phase discontinuity between the shifted frequency signals is described. Two squarewave signals having an integral relationship to a clock signal are sequenced to produce one squarewave output signal. The transition from one squarewave signal to the other is made to occur at the end of a whole cycle of the first and at the beginning of a whole cycle of the second resulting in a phase continuous output signal.
Official Gazette of the U.S. Patent Office

N71-23446# Air Force Cambridge Research Labs., Bedford, Mass.
RADIO PROPAGATION EFFECTS DUE TO IONOSPHERIC WAVES
Kurt Toman 3 Dec. 1970 27 p refs
(AD-718106; AFCRL-70-0688; ERP-342) Avail: NTIS CSCL 20/14

Acoustic-gravity waves in the ionosphere create moving, undulating, reflecting surfaces. Overhead passage of such surfaces causes variations of amplitude, phase, and frequency of reflected radio waves. The patterns of these variations change with the characteristics of the reflecting surface. For the study and prediction of these patterns, computer experiments were carried out to simulate the effects of sinusoidal reflecting surfaces on propagating radio waves. The simulated parameters included field strength and path length and its derivative. The results are compared with high-frequency measurements made over an oblique, ionospheric transmission between Ottawa, Canada, and Bedford Mass.
Author (GRA)

N71-23451# Advisory Group for Aerospace Research and Development, Paris (France).
TROPOSPHERIC RADIO WAVE PROPAGATION, PART 2
Feb. 1971 366 p refs Conf. held at Duesseldorf, 31 Aug. – 4 Sep. 1970 Mostly in ENGLISH; partly in FRENCH
(AGARD-CP-70-71) Avail: NTIS HC$6.00/MF$0.95

The effects of tropospheric medium characteristics on radio transmission are reported. Parameters of tropospheric scatter propagation, and tropospheric propagation predictions are considered. For individual titles see: N71-23452 through N71-23474.

N71-23452# Rome Univ. (Italy). Electronics Inst.
PROPAGATION EFFECTS OF A VARIABLE SCATTER MECHANISM
Giovanni d'Auria *In* AGARD Tropospheric Radio Wave Propagation, Part 1 Feb. 1971 18 p refs (See N71-23451 12-07)
Avail: NTIS HC$6.00/MF$0.95

The scattering of electromagnetic waves determined by

the refractive index irregularities of the troposphere is reviewed, bearing in mind its effects in radio propagation. The mathematical formulation of the problem is briefly recalled, both for reference purposes and in order to emphasize the meaning of the hypotheses generally assumed. Particular attention in this survey is given to experimental researches contributing to a better understanding of the tropospheric scatter mechanism. Author

N71-23453# Stanford Univ., Calif. Electronics Labs.
ANGLE AND DOPPLER MEASUREMENTS OF THE SPECULAR AND SCATTERED COMPONENTS OF TRANSHORIZON MICROWAVE SIGNALS
Nicholas Cianos and Alan T. Waterman, Jr. *In* AGARD Tropospheric Radio Wave Propagation, Part 2 Feb. 1971 13 p refs (See N71-23451 12-07)
(Contract DAAB07-70-C-0138)
Avail: NTIS HC$6.00/MF$0.95

A summary and interpretation of transhorizon propagation experiments at 3.2 GHz over a 164 km (102 miles) path using a modified vertical 12-element data gathering array and receiving system is presented. The measured amplitude and phase data recorded by the antenna array are processed to obtain the array angular response patterns, and the signal amplitude distributions and Doppler spectra. The radio data are supplemented with refractivity and temperature profiles. The occasions when strong layers are present are revealed not only by the meteorological profiles but also by the transhorizon signal. Author

N71-23454# Air Force Cambridge Research Labs., Bedford, Mass.
COMPARISON OF TURBULENT LAYER MODELS AND HIGH RESOLUTION FORWARD-SCATTER RESULTS
Uve H. W. Lammers and John W. B. Day (Commun. Res. Centre) *In* AGARD Tropospheric Radio Wave Propagation, Part 2 Feb. 1971 9 p refs (See N71-23451 12-07)
Avail: NTIS HC$6.00/MF$0.95

The theoretical resolution of a long range, scanning forward-scatter system has been studied, assuming narrow layers of homogeneously turbulent refractivity for the tropospheric height range from 5 to 15 km. Tropospheric composition, as determined experimentally through high resolution mapping techniques within the same regime, is analyzed for its spatial and temporal significance. The results indicate that a horizontal orientation frequently exists in the upper tropospheric structure. However, this is not the general case. Based on the common volume resolution and the range of the troposphere monitored, layers have been found to extend from 20 to 100 km and in rare cases up to 200 km with vertical widths from the resolution limit (0.7 km) to several kilometers. On the average, the turbulent homogeneity of the scattering medium is spatially and temporally quite limited, particularly in the vertical direction. Author

N71-23455# Hamburg Univ. (West Germany). Inst. for Radiometeorology.
OBSERVATIONS WITH SYNCHRONOUSLY OFFSET BEAMS ON A 77 km PATH AT 1.8 AND 4.4 cm
H. D. Seehars *In* AGARD Tropospheric Radio Wave Propagation, Part 2 Feb. 1971 10 p (See N71-23451 12-07)
Avail: NTIS HC$6.00/MF$0.95

Radio experiments on transhorizon links due to variations of the wavenumber vectors or displacements of the constant wavenumber vectors in space, indicate the variations of the wavenumber spectrum. Results of these experiments on 1.8 and 4.4 cm wavelengths point to shapes of refractive index wavenumber spectra that show a strongly marked variance, but indicate a median value close to 11/3 corresponding to the theory of Megaw-Obukhov. The test of the homogeneity leads to an increase of the vertical and horizontal homogeneity with decreasing wavelength. Experiments on 4.4 cm point to a vertical inhomogeneity of about 1 db/100 m. Isotropy tests applied have demonstrated that there exists a weak anisotropy of turbulence which is not dependent on the frequency. Author

N71-23456# Imperial Coll. of Science and Technology, London (England).
A STUDY OF THE EFFECTS OF TROPOSPHERIC AIR MASS MOVEMENTS ON THE FADING CHARACTERISTICS OF UHF TRANSMISSION BY THE USE OF A LABORATORY MODEL
W. G. Burrows *In* AGARD Tropospheric Radio Wave Propagation, Part 2 Feb. 1971 16 p refs (See N71-23451 12-07)
Avail: NTIS HC$6.00/MF$0.95

Various types of fading characteristics, obtained from a non-optical U.H.F. link, are simulated in a simple laboratory model. The fading characteristics obtained from both the real full scale system and the model are described, for the purpose of comparison, by their power spectra. Results are given to show that, by comparing the air mass movements created in the laboratory model to produce a particular type of fading and those which might exist for the particular meteorological conditions under which similar fading characteristics were obtained for the real full scale system, surface wind velocity is a significant parameter. This result, together with the unusual observations of air mass movements in the model, suggests that near surface circulatory air mass movement along a tropospheric path can give rise to significant distortion to the shape of the transmitter beam. This leads to the conclusion that transhorizon propagation in the tropospheric medium may be attributed to the effective divergence of a beam due to air mass lenses distributed along a given path. Author

N71-23457# Federal German Post Office, Darmstadt (West Germany). Research Inst.
METHODS OF DISTINGUISHING SCATTER AND PARTIAL REFLECTION AT TROPOSPHERIC TRANSHORIZON PATHS
L. Fehlhaber *In* AGARD Tropospheric Radio Wave Propagation, Part 2 Feb. 1971 14 p refs (See N71-23451 12-07)
Avail: NTIS HC$6.00/MF$0.95

Two distinct theories of tropospheric transhorizon propagation have been set up during the past years: Scattering by random refractivity fluctuations and partial reflection from layer-like structures. More recent investigations showed, that both mechanisms exist simultaneously with varying share and that this share depends on frequency, distance, altitude of the layer and on the state of the troposphere. In order to investigate the problem of the sharing of the two mechanisms, a simplified model of partial reflection has been derived, taking into account known tropospheric parameters. This model has been worked out numerically, and it has been found to agree well with empirical data. From the results it can be infered that partial reflection from finite patches of steep refractivity gradients prevails with frequencies up to 200 MHz. With the higher frequencies scattering seems to predominate at all path lengths except the very short ones. Author

N71-23458# Federal German Post Office, Darmstadt (West Germany). Research Inst.
OBSERVATIONS ON A 12 GHz SCATTER LINE OVER A 210 km PATH
N. Abel *In* AGARD Tropospheric Radio Wave Propagation, Part 2 Feb. 1971 9 p refs (See N71-23451 12-07)
Avail: NTIS HC$6.00/MF$0.95

Knowledge on transhorizon propagation at frequencies above 10 GHz is important in radiocommunications whenever transhorizon links are used or problems of interference between different radio systems must be solved. Some first results from about one year of observations on a 12 GHz link over a 210 km path are presented. In certain cases, signal types attributed to tropospheric scatter, partial reflections, or attenuation and scattering by

precipitation are distinguished, although the exact share of these propagation effects was not yet determined. Tropospheric scatter by far prevails and thus determines the mean transmission loss relative to free space, which was found to agree well with predicted values and seems to be some decibels smaller than at 2 GHz on a similar link. A correlation exists between transmission loss and atmospheric temperature near the scattering volume. Author

N71-23459# Marconi Co., Ltd., Great Baddow (England). Research Labs.

ANGLE DIVERSITY APPLIED TO TROPOSPHERIC SCATTER SYSTEMS

M. W. Gough *In* AGARD Tropospheric Radio Wave Propagation, Part 2 Feb. 1971 16 p refs (See N71-23451 12-07)

Avail: NTIS HC$6.00/MF$0.95

The generation of substantially independent signal paths over a tropospheric scatter link by directing two or more narrow beams at different scattering regions in the troposphere makes an attractive alternative to space diversity. The above factors are discussed and evaluated with the aid of a published theoretical treatment of tropospheric scattering which is well supported by experiment, and careful consideration is given to the influence of atmospheric layering. It is shown how the aggregated losses enumerated above may be minimized for a specified angle diversity system by correct choice of horn feed dimensions in relation to a conventional paraboloid reflector. Various two way angle diversity systems involving quadruple and six fold diversity are evaluated, and their optimized performances are compared with that of a conventional space/frequency quadruple diversity system using four antennas per link of like size. Author

N71-23460# Saarland Univ., Saarbrucken (West Germany). Inst. for Applied Physics and Electronics.

DEPOLARIZATION OF DIPOLE RADIATION IN A MEDIUM WITH A STATISTICALLY HOMOGENEOUS AND ISOTROPIC DISTRIBUTION OF DIELECTRIC CONSTANT

W. Mohr *In* AGARD Tropospheric Radio Wave Propagation, Part 2 Feb. 1971 10 p refs (See N71-23451 12-07)

Avail: NTIS HC$6.00/MF$0.95

The solutions of the vector wave equation with a Hertzian dipole as source term are considered in a medium with statistically homogeneously and isotropically fluctuating permittivity. For the two limits, wavelength much greater or much smaller than the correlation length of the fluctuations, the autocorrelation function of the depolarized part of the field is calculated by approximation methods. The limit of small wavelength is treated by the perturbation method; in the limit of great wavelength a renormalized dyadic Green's function is used to calculate the first term of the staircase approximation for the Bethe-Salpeter equation. The physical aspects of the formulas are discussed. Author

N71-23461# Saarland Univ., Sarrbrucken (West Germany). Inst. for Applied Physics and Electronics.

EFFECT OF VEGETATION UPON ANTENNA PATTERN WITH SCATTER PROPAGATION ON UHF

R. Zapp *In* AGARD Tropospheric Radio Wave Propagation, Part 2 FEB. 1971 7 p refs (See N71-23451 12-07)

Avail: NTIS HC$6.00/MF$0.95

The pattern of an antenna radiating with a small elevation angle as used in scatter propagation, is disturbed by scattering of the field at the vegetation of the antenna's foreground. The vegetation can be regarded as a configuration of randomly distributed scatterers with random scattering properties. The irregular motion of the vegetation caused by wind leads to similar fading and depolarization of the transmitted field as known from tropospheric scatter propagation. The scatterers are described by their dielectric constants. Using the perturbation expansion, series are derived for the average value of the field. The formalism regards the scattered field as a superposition of all the fields scattered from each scatterer of a fixed configuration. The concept of randomness requires averages to be taken over a statistical ensemble of scatterer configurations. Their multidimensional probability distribution is re-expressed in terms of the one-scatterer distributions so as to take account of coherent scattering. Author

N71-23462# Michigan State Univ., East Lansing.

CONTROLLABILITY AND SOLVABILITY OF THE WAVE PROPAGATION IN TROPOSPHERE

M. Z. v. Kazywoblocki *In* AGARD Tropospheric Radio Wave Propagation, Part 2 Feb. 1971 12 p refs (See N71-23451 12-07)

Avail: NTIS HC$6.00/MF$0.95

The fundamental concepts of the theory of optimization and controllability are reviewed and applied to the system of field equations of the wave propagation in the troposphere. Then follows a brief review of other methods and a discussion on the refractive index, its methods of calculation and tests. Controllability in the troposcatter propagation closes the study. Author

N71-23463# Signatron, Inc., Lexington, Mass.

SIGNAL DISTORTION AND INTERMODULATION WITH TROPOSPHERIC SCATTER

P. A. Bello, L. Ehrman, and P. Alexander *In* AGARD Tropospheric Radio Wave Propagation, Part 2 Feb. 1971 18 p refs (See N71-23451 12-07)

Avail: NTIS HC$6.00/MF$0.95

Multipath models used in the past for predicting the signal distorting properties of troposcatter links are reviewed. The fundamental importance of the delay power spectrum in predicting signal distortion is developed in some detail. Suggestions are given for improving multipath modeling by including beam bending and scintillation. The concept of beam broadening as producing increased multipath is shown to be erroneous. Some attention is given to relationships between multipath spread and path loss. Author

N71-23464# Florida Univ., Port Canaveral.

FREQUENCY CORRELATION FUNCTION FOR TROPOSCATTER CIRCUITS

A. M. Manders *In* AGARD Tropospheric Radio Wave Propagation, Part 2 Feb. 1971 17 p refs (See N71-23451 12-07)

Avail: NTIS HC$6.00/MF$0.95

A mathematical model for the frequency correlation function of a tropospheric scatter channel is presented. The model uses atmospheric conditions and channel parameters as inputs. The results are presented in a form that allows estimation of the frequency correlation function under stable and unstable tropospheric conditions. Author

N71-23465# Martin Marietta Corp., Orlando, Fla. Communications and Electronics Div.

CORRELATION BANDWIDTH MEASUREMENTS OVER TROPOSCATTER PATHS

Richard A. Branham *In* AGARD Tropospheric Radio Wave Propagation, Part 2 Feb. 1971 21 p refs (See N71-23451 12-07)

(Contract DAAB07-69-C-0251)

Avail: NTIS HC$6.00/MF$0.95

Propagation measurements were made over four troposcatte paths; simultaneous measurements of cross correlation coefficient versus frequency from zero to 9 MHz were obtained at 4.62 and 7.6 GHz in increments of 1 MHz. The paths were operated cyclically for two to five week periods to obtain the effects of season, terrain, weather, and time of day. Special tests covering 200 kHz frequency increments up to 800 kHz were also made. The signal strengths were recorded on magnetic tape and reduced in a digital computer to yield cross correlation versus frequency, and distributions of fade durations, rates, signal amplitudes and fade

depths. Emphasis is primarily placed on the cross correlation measurements. Author

N71-23466# Bell Telephone Labs., Inc., Holmdel, N.J.
CHARACTERIZATION OF TROPOSPHERIC SCATTER CHANNELS BY IMPULSE RESPONSE MEASUREMENT
C. C. Bailey *In* AGARD Tropospheric Radio Wave Propagation, Part 2 Feb. 1971 12 p refs (See N71-23451 12-07)
Avail: NTIS HC$6.00/MF$0.95

A new experimental program for evaluating the transmission capabilities of the tropospheric scatter medium is reported. A correlation type impulse response measurement system and a recently completed tropospheric scatter radio test link are described. Results of evaluation tests of the impulse response measurement system are presented in order to indicate its measurement capabilities and the type of information which can be obtained from it. Examples of experiments conducted with a troposcatter simulator and results from these experiments are given. Author

N71-23467# Forschungsinstitut fuer Hochfrequenzphysik, Bonn (West Germany).
CALCULATING TROPOSCATTER INTERCHANNEL DISTORTION USING A MONTE CARLO METHOD
A. Wasiljeff *In* AGARD Tropospheric Radio Wave Propagation, Part 2 Feb. 1971 10 p refs (See N71-23451 12-07)
(Contract T-01012)
Avail: NTIS HC$6.00/MF$0.95

Multichannel signals are simulated by sets of randomly phased sinusoids uniformly spaced in frequency. The amplitudes of the sinusoids are set according to the prescribed preemphasis characteristic, some of them are set to zero to form the idle channels. The signal is transformed into the time domain with the aid of fast Fourier synthesis. This time signal is the modulation function for the transmitted electromagnetic field. The field which reaches the receiver after having been scattered by a tropospheric volume is described with the help of an integral including the spatial Fourier transform of the autocorrelation function of the dielectric constant in the tropospheric scatter volume. Analytical performance of demodulation of the calculated field in the receiver yields the distorted time function. Again the fast Fourier transform is used to analyze this function. The power density in the channels which had been originally idle is a measure of interchannel distortion. The process is repeated with a sequence of random noise samples from each sample with a set of independent random phases. The distortion is averaged to obtain the desired solution. The results of the Monte Carlo method approach those obtained by measurements with Gaussian noise. Author

N71-23468# Centre National d'Etudes des Telecommunications, Issy-les-Moulineaux (France).
PROPAGATION BY ATMOSPHERIC HETEROGENEITIES AND FORECAST OF ATTENUATION [PROPAGATION PAR LES HETEROGENEITES DE L'ATMOSPHERE ET PREVISION DES AFFAIBLISSEMENTS]
J. Battesti and L. Boithias *In* AGARD Tropospheric Radio Wave Propagation, Part 2 Feb. 1971 15 p refs In FRENCH (See N71-23451 12-07)
Avail: NTIS HC$6.00/MF$0.95

A formula for calculating radio attenuation fluctuation as function of distance during propagation in a homogeneous atmospheric layer is developed that uses primary indice gradients of the transmitting volume for calculating the receiving level. Considered are: (1) starting angle effects as determined by angular and geographical distances; (2) intercommunication altitude effects; (3) antenna gain loss characteristics; (4) distance, climate, and starting angle effects on antenna gain loss; (5) a limiting law for gain loss in high resolution antennas; and (6) effects of antenna gain characteristics, distance and starting angles on transmissible bandwidth. Transl. by G.G.

N71-23469# AEG-Telefunken, Backnang (West Germany). Dept. of Radio Link Systems.
PROPAGATION CHARACTERISTICS OF TROPOSPHERIC SCATTER RADIO LINKS IN THE 5 GHz RANGE WITH RESPECT TO PATH LOSS PREDICTIONS
Klaus Radermacher and Guenther Reppallier *In* AGARD Troposphere Radio Wave Propagation, Part 2 Feb. 1971 10 p refs (See N71-23451 12-07)
Avail: NTIS HC$6.00/MF$0.95

Planning of stationary and use of mobile tropospheric scatter systems require prediction methods of tropospheric scatter losses for links in any climate. Prediction methods are considered as to their application and compared to the current state of knowledge in the field of tropospheric scatter propagation. Test results obtained by field testing a new mobile tropospheric scatter system, operating in the band about 4.5 GHz, on four paths are compared with predictions. The test results were apparently, at times, adversely affected by anomalous weather conditions. Frequency saving operation with quadruple space diversity using two polarizations is possible. Author

N71-23470# Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven (West Germany).
DAILY AND HOURLY FORECAST OF TROPOSPHERIC PROPAGATION PARAMETERS
H. J. Albrecht *In* AGARD Tropospheric Radio Wave Propagation, Part 2 Feb. 1971 12 p refs Supported by Min. of Defence, W. Germany (See N71-23451 12-07)
Avail: NTIS HC$6.00/MF$0.95

The present state of the art of daily and hourly forecasts of tropospheric propagation parameters, on the basis of research work known at this juncture is summarized. In accordance with the subject matter, frequent reference is made to meteorological conditions and their predictions. Following analyses on propagation aspects and their predictability, meteorological aspects as well as the predictability for specified telecommunication links are considered. Author

N71-23471# Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven (West Germany).
SHORT TERM FORECAST OF SIGNAL BEHAVIOUR WITH TROPOSPHERIC SCATTER LINKS
D. E. Marquart *In* AGARD Tropospheric Radio Wave Propagation, Part 2 Feb. 1971 49 p refs (See N71-23451 12-07)
Avail: NTIS HC$6.00/MF$0.95

Forecasts of signal attenuation with tropospheric scatter links by means of meteorological values have shown that considerable increases of signal attenuation correlate with the passage of cold fronts through the scatter volume and that the intensity of this signal decrease is related to the age of the front. Considered is the present state of research work with particular attention on the interpretation of correlation results; a detailed comparison between predicted and observed signal behavior is presented. In addition, signal enhancements and their possible forecasts on the basis of the occurrence probability of super-refraction layers is dealt with. Other parameters determining general signal behavior are also treated. Author

N71-23472# Institute for Telecommunication Sciences, Boulder, Colo.
PREDICTION OF TROPOSPHERIC RADIO TRANSMISSION LOSS OVER IRREGULAR TERRAIN
A. G. Longley and P. L. Rice *In* AGARD Tropospheric Radio Wave Propagation, Part 2 Feb. 1971 8 p refs (See N71-23451 12-07)
Avail: NTIS HC$6.00/MF$0.95

A method for calculating long term median radio transmission loss over irregular terrain at frequencies above 20 MHz is described. The model is particularly useful for area predictions of transmission

loss as a function of distance, frequency, antenna heights, and terrain characteristics where individual path profiles are not known. Such predictions are needed for military communication and surveillance; for land mobile, broadcasting, and air-to-ground systems; and for calculating preliminary performance estimates for system design. The prediction model summarizes much of our present knowledge of tropospheric propagation theory and has been tested against measurements over a wide range of distances, for frequencies from 20 to 10,000 MHz, for terrain types ranging from smooth plains to rugged mountains, and with antenna heights ranging from very low to aircraft heights. Author

N71-23473# Lockheed Electronics Co., West Long Branch, N.J.
STATISTICAL PROPAGATION MODEL FOR IRREGULAR TERRAIN PATHS BETWEEN TRANSPORTABLE AND MOBILE ANTENNAS
J. P. Murphy *In* AGARD Tropospheric Radio Wave Propagation, Part 2 Feb. 1971 21 p refs (See N71-23451 12-07)
(Contract DAAB07-67-C-0104)
Avail: NTIS HC$6.00/MF$0.95

A statistical model of tropospheric radio propagation loss that can be used by ground mobile radio communications systems designers without the aid of a computer program is developed. Such a model provides a first order estimate of median values and standard deviation values of basic transmission loss for path over a particular type of terrain based on the assumption that path-to-path variability of basic transmission loss is close to that of a normal distribution in decibels. The method used to develop the model is closely related to the one used to develop the Egli model for radio propagation above 40 MHz over irregular terrain. The data used to develop the model have been measured on paths between antennas that are transportable and antennas that are mobile. The only independent parameters used are signal frequency, antenna heights and path distance. Author

N71-23474# Hamburg Univ. (West Germany). Meteorological Inst.
THE STATE OF RADAR RANGE PREDICTION OVER SEA
H. Jeske *In* AGARD Tropospheric Radio Wave Propagation, Part 2 Feb. 1971 11 p refs (See N71-23451 12-07)
Avail: NTIS HC$6.00/MF$0.95

The methods of radar range prediction of marine cm-radars are closely related to the boundary layer theory, for the propagation conditions are governed by the low level evaporation duct in 85% of time. Over a wide range of atmospheric stability, the logarithmic profile with a stability-dependent profile coefficient yields a good correlation between radio field strength and duct thickness. For strong deviations from the neutral equilibrium, however, more complicated profile forms are employed. Author

N71-23508# Royal Radar Establishment, Malvern (England).
COMPUTER SIMULATION OF MTI
E. J. Dodsworth and J. Hathaway Jun. 1970 26 p refs
(RRE-TN-759) Copyright. Avail: NTIS

A computer program has been written which provides an estimate of the performance of an MTI system in terms of the probability of clutter false alarms and the probability of detecting an aircraft in cluttered areas. Among other factors, the program takes into account the usual fading of aircraft signals and the wide range of clutter signal levels that can be found in practice over an area of clutter. The clutter model used is based on measurements at S-band at Malvern. The parameters of the MTI system being studied can be varied at will. Most of the results presented are for a system at constant prf using a limiting receiver, double cancellation and noncoherent integration, scanning at a rate giving 5 pulses per beamwidth. It is shown that, although limiting is effective in controlling the number of false alarms from strong clutter signals, the MTI improvement factor is considerably reduced as a result of limiting. As a consequence of this there is no advantage in using double rather than single cancellation as regards the probability of detecting an aircraft over the assumed clutter area. Results are also given for an AGC system which provides better performance than limiting, although it would be more difficult to implement in practice. Author (ESRO)

N71-23528# School of Aerospace Medicine, Brooks AFB, Tex.
SIX INDICES FOR PREDICTING SPEECH INTERFERENCE WITHIN AIRCRAFT Final Technical Report, 1 Oct. 1968–6 Jul. 1970
Donald C. Gasaway Dec. 1970 35 p refs
(AD-718098; SAM-TR-70-72) Avail: NTIS CSCL 17/2

Acoustic noise within aircraft during flight often causes some degree of interference with aural communication. Several methods have been used over the years to identify and predict degrees of speech interference. Six of these methods are discussed: four involve octave-band averaging; two use frequency weighting. The assessment is based on application of each of the six indices to noise levels measured within the cockpits of 191 fixed-wing and 58 rotary-wing aircraft, grouped into 11 categories by engine type. Equivalent speech interference levels obtained from the use of each of the six indices are provided for the acoustic spectra developed for the 11 classes of vehicles. The operational considerations which influence speech interference values are described. Noise attenuation provided by headset devices commonly used by Air Force aircrew members is shown for different groups of noise spectra. Criteria are given for evaluating protected and unprotected exposures to noise that compromise communications. Author (GRA)

N71-23529# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
QUALITATIVE FREQUENCY ACCURACY AND STABILITY
21 Dec. 1970 10 p refs
(AD-718786; MTP-6-3-514) Avail: NTIS CSCL 17/2

The document provides procedures for the qualitative evaluation of Frequency Accuracy and Stability characteristics of communication-electronics items which generate and/or utilize audio/radio frequencies in mission accomplishment. Author (GRA)

N71-23536# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AN INVESTIGATION OF THE CROSS CORRELATION OF SPEECH SIGNALS
B. N. Epifantsev 16 Nov. 1970 15 p refs Transl. into ENGLISH from Tr. Politekhn. Inst. (Leningrad), no. 291, 1968 p 134–140
(AD-717869; FTD-MT-24-100-70) Avail: NTIS CSCL 17/2

All information available in speech signals is used for classifying these signals according to the degree of connection between a given speech signal and a reference signal. An averaged cross correlation coefficient determined within the entire frequency-time range of existence of the test functions was adopted as the degree of connection. A sort of dynamic spectrograph was used for speech processing; from microphone M, the speech signal - via frequency corrector FC, band filters BF, and square-law detectors SD - was applied to 10 low-pass filters LPF (time constant, 10 m sec). The entire transmission channel had an averaging time of about 13 msec. Ten energy envelopes appeared at the LPF outputs. Time quantization was performed by switch Sw which scanned the channels at a rate of 800 Hz with a channel-interrogation time of 1.25 msec. Thus, a word said before the microphone M could be recorded in the storage of a digital computer; the latter could calculate the cross correlation factor between a said word and a previously-stored reference word. It was found that the above method can reliably recognize a limited number of words (five words pronounced by 7 men and 4 women were used in the experiments). Author (GRA)

N71-23537# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RELIABILITY OF DATA TRANSMISSION OVER RADIO RELAY CHANNELS
S. S. Kosenko 6 Nov. 1970 9 p Transl. into ENGLISH from Avtomatika, Telemekhan. i Svyaz (Moscow), v. 13, no. 12, 1969 p 8–9
(AD-718483; FTD-HT-23-797-70) Avail: NTIS CSCL 17/2

In an analysis of data-transmission reliability over radio-relay channels, the author cites figures of 4 garbled symbols per 10,000 transmitted over a 384-km-long link operating with RM-24 equipment and 4 garbled per 100,000 transmitted over a 150-km-long link worked with RTA-24. Errors were found to be primarily of the burst type. Time-division multiplexing and the Hungarian-produced DM-400/6 delta modulation equipment are recommended for use on industrial railroad communication circuits. A comparative table is presented showing the probability of error for a variety of circuit types. Author (GRA)

N71-23589# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ERROR PERFORMANCE BOUNDS FOR TWO RECEIVERS FOR OPTICAL COMMUNICATION AND DETECTION
Edward A. Bucher 10 Nov. 1970 20 p refs
(Contract F19628-70-C-0230)
(AD-718099; TN-1970-18; ESD-TR-70-349) Avail: NTIS CSCL 17/2

The report examines two possible receiver strategies for use with photoelectron emitting optical detectors. The Poisson statistics of these photoelectron emissions are used to find simple easily evaluated but tight upper bounds on error probability with both receiver decision rules. Upper bounds on error probability are derived for both M-ary PPM communication with a maximum likelihood receiver and for a fixed threshold radar detection receiver. These receiver performance bounds illustrate several differences between optical or quantum communication and conventional communication. These differences are discussed in detail. Author (GRA)

N71-23607# Federal Communications Commission, Washington, D.C. Research Div.
DETAILED ANALYSIS OF PRECIPITATION DATA: FCC/USAF POPSI PROJECT
Roger B. Carey and Gary S. Kalegian 15 Dec. 1970 49 p refs
(AD-718270; R-7003) Avail: NTIS CSCL 20/14

The electromagnetic field strength measurements obtained during the 1966 FCC/USAF POPSI Project have been classified according to propagation mode and the data from periods of precipitation have been analyzed in detail. Cumulative probability distributions were generated for the effective radar reflectivities derived from the bistatic electromagnetic measurements and compared with the probability distributions of the surface rainfall rates derived from the accumulations of the United States Weather Bureau recording rain gauges in the area. The distribution functions were then adjusted by means of a least squares regression line. The relationship thus obtained has been compared with other Z-R relationships based upon the analysis of drop size distributions and has been tested against independent rain gauge data in the POPSI Project area. The final approximation resulted in a standard deviation for estimating Z(p) from R(p) of less than 1.6 dB for the New Jersey rainfall data. The altitude dependence of the reflectivity from precipitation-connected phenomena in the New Jersey coastal area has been demonstrated and discussed to some extent. Author (GRA)

N71-23608# Stanford Univ., Calif. Electronics Labs.
ADVANCED RESEARCH IN PROPAGATION TECHNIQUES Quarterly Report, 20 Aug. – 19 Nov. 1970
A. T. Waterman, Jr. Feb. 1971 17 p refs
(Contract DAAB07-70-C-0138)
(AD-718272; SU-SEL-70-080; ECOM-0138-3; QR-3) Avail: NTIS CSCL 20/14

The report deals with research on propagation of microwaves between two points on earths surface separated a distance considerably beyond line of sight. Frequency used is 3.2 GHz. Receiving system employs an antenna array which permits wave front sampling. Propagation measurements are supplemented by meteorological measurements 0.9 temperature, humidity turbulence etc. Profiles of refractive index are obtained by flying a plane equipped with a microwave refractometer through the atmospheric path in which the signal is scattered. Author (GRA)

N71-23648# Verband Deutscher Elektrotechniker, Frankfurt (West Germany).
TELECOMMUNICATION MEASUREMENTS FOR AUTOMATIC PRODUCTION AND MAINTENANCE
H. Fleischer *In* NBS Innovative Metrology: Key to Progr. Mar. 1971 p 125–128
Avail: SOD $1.50

Automatic records with uncertainties no greater than 0.1 db up to 18 MHz are used in one channel of a microwave link to measure effective equivalence and noise level to provide production calibration control for filters and attenuators. Details of two German-made systems are described. Author

N71-23668 Pennsylvania Univ., Philadelphia.
MILLIMETER WAVE IMAGE CONVERSION
Burton Joshua Levin (Ph.D. Thesis) 1969 169 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 70-7818

Image conversion at millimeter wavelengths using a semiconductor panel is theoretically and experimentally investigated. A model is developed for the photoconductive readout of this device under dynamic scan conditions. Static probing of the excess carrier density under various photoexcitation geometries has verified this model. The important material properties for imaging purposes are shown to be the excess carrier lifetime, the surface recombination velocity, the ambi-polar diffusion constant, the carrier mobilities, and the forbidden gap energy. At the present state of the art, germanium is shown to be the most promising material. Image conversion using a germanium panel in the reflection mode of operation is demonstrated at 70 GHz. Dissert. Abstr.

N71-23670 National Lending Library for Science and Technology, Boston Spa (England).
ON THE EFFECTS OF A RADIO MAST ON A SUNSHINE RECORDER AND HOW TO COUNTERACT THEM
Ichiro Kikuta 19 Jan. 1971 7 p Transl. into ENGLISH from Sakko Jino (Tokyo), no. 36, 1969 p 185–187
(NLL-M-20185-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A self supporting steel mast 23 m high was constructed for radio telephone communications and erected on a small vacant space to the south of the meteorological observatory building, and to the east of the previously built panzer mast. Thus, in winter, when the height of the sun was low, the shadow of the steel mast was cast on the sunshine recorder. The moving of the sunshine recorder mounting from that site was visualized originally; a number of problems had to be solved and their outline is discussed. Author

N71-23729 Pennsylvania Univ., Philadelphia.
RESPONSE OF QUANTUM MECHANICAL RESONANCES TO MODULATED RADIO FREQUENCY SIGNALS
Roland Paul Kenschaft (Ph.D. Thesis) 1969 166 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 70-7813

An electronic circuit obeying the Bloch equations is presented. Familiar nonlinear properties of the resonance and various approximate solutions are related to the equivalent circuit. Transformations and matrix formulations of the equations are introduced to simplify calculations of modulation response. Analytic results are obtained for three forms of modulation: weak FM, step FM, and square-wave FM. General properties of broadening and peaking of the modulation response at large EF level are discussed. Hyperfine atoms, such as rubidium-87, possess additional states which are only indirectly affected by the RF signal but which affect the responses. Necessary modifications of the theory, the equivalent circuit, and the modulation solutions appropriate to hyperfine systems are described. The Bloch equations are shown to be a good approximation unless strong optical pumping is employed; and experimental test of this condition is indicated. Dissert. Abstr.

N71-23786# Royal Aircraft Establishment, Farnborough (England).
THE PREDETECTION MAGNETIC TAPE RECORDING OF AM/FM AND FM/FM TELEMETRY SIGNALS [DIE MAGNETBANDREGISTRIERUNG VON AM/FM- UND FM/FM-SIGNALEN DURCH AUFZEICHNUNG DER EMPFAENGER-ZF (PREDETECTION RECORDING)]
H. Bothe Nov. 1970 36 p refs Transl. into ENGLISH of Deutsche Luft- und Raumfahrt report DLR-FB-68-34
(RAE-Lib-Trans-1518; DLR-FB-68-34) Avail: NTIS

The pre-detection magnetic tape recording of AM/FM and FM/FM telemetry signals is investigated. Theoretical evaluations of noise voltages and test measurements on 6 magnetic tape recorders of different manufacturing companies are described. The estimations and test results are used to determine the suitability of the equipment for storing telemetry signals on magnetic tape. Simple test procedures are indicated. Author

N71-23787 Pennsylvania State Univ., University Park.
DESIGN PROCEDURES FOR SEQUENTIAL CIRCUITS USING ac GATED FLIP-FLOPS
Paul Thomas Hulina (Ph.D. Thesis) 1969 134 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 70-7212

A transition table is derived for both the gated R-S and J-K flip-flops. In the case where a clock input is applied to the a.c. input of the flip-flops, the transition tables reduce to the familiar transition tables for the standard R-S and J-K flip-flops. A precedure is specified for the synthesis of clocked synchronous sequential circuits using gated flip-flops. The resulting circuit implementations are not of the normal parallel input type. That is, the clock need not be taken to the a.c. inputs of all flip-flops. In the circuits synthesized, non-parallel input implementation required less logic than the corresponding parallel input implementation. Dissert. Abstr.

N71-23909 New Mexico Univ., Albuquerque.
A DEVICE TO AUTOMATICALLY MAXIMIZE THE POWER RADIATED FROM REENTRY VEHICLES
John Stanton Potts (Ph.D. Thesis) 1969 282 p
Avail: Univ. Microfilms: HC $12.85/Microfilm $3.65 Order No. 70-10129

The device is referred to as the compensator due to the nature of its operation and consists of three basic elements; the detection device, the correction device, and a control system. It is shown theoretically that the increase in radiated power will become significant for large mismatch values and that the load can vary rapidly from one mismatch to another without any energy being reflected to the transmitter. An analysis of the stability of the system has indicated the compensator to be stable. A computer program was written to closely simulate the operation of the compensator and also indicated the system to be stable as well as showing the response time to compensate for several values of load mismatch. A prototype was constructed and thoroughly tested to determine the frequency response, insertion loss, reaction time, pulse response, sensitivity to changes in power level and the dc power requirements. System tests were also performed. The results of these tests indicated good agreement with theory as well as demonstrating the capability of the prototype. Dissert. Abstr.

N71-23929 Montana State Univ., Missoula.
A REPRESENTATION FOR THE INFORMATION CARRYING UNITS OF NATURAL SPEECH
William Phillips Rupert, Jr. (Ph.D. Thesis) 1969 129 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 70-10026

A new representation of human speech forms the basis for the design of a system for extracting the linguistically encoded information of natural speech. The parameterization of the acoustic speech signal begins with a predictive segmentation that provides boundaries of signal epochs of homogeneous character. The acoustic details of each segment are recorded, and the segments are classified as one of eleven production modes. A relative opposition characterizes the distinctive changes in the signal character between adjacent production modes as an ordered set of elementary calculations that provide a detailed description of the relationship between production modes 1 and production modes 1+1. The complete representation of an utterance is then a sequence of elements (PM's) and the relationships between them (RO's) that are consistent over divers speakers. Dissert. Abstr.

N71-23930 Texas Univ., Austin.
RADAR ESTIMATION OF MICROWAVE ATTENUATION BY HYDROMETEORS
Martha Carolyn Shultz Fowler (Ph.D. Thesis) 1969 180 p
Avail: Univ. Microfilms: HC $8.20/Microfilm $3.00 Order No. 70-10788

Space communications in the 10 to 100 GHz band are affected by severe atmospheric attenuation. The factors of concern are gaseous absorption and hydrometeorological absorption and scattering. Selection of the bands 10 to 20 GHz and 30 to 40 GHz eliminates the first, but hydrometeors continue to be detrimental. Both attenuation and cross section are functions of frequency; consequently, a dual frequency system is proposed. The cross section is measured at a frequency low enough to have negligible attenuation. Existing theory allows the estimation of the attenuation at the higher frequency from this measurement. Limitations of the theory are discussed and several tests are performed. Dissert. Abstr.

N71-23979# Australian Post Office Research Labs., Melbourne.
C.C.I.T.T SIGNALLING SYSTEM NO. 6 FIELD TRIAL, PROJECT REVIEW
G. L. Crew Dec. 1970 42 p refs
(Rept-6567) Avail: NTIS

Design and developments of equipment and software for the common channel international telephone and telemetry system No. 6 project just prior to the commencement of the field trial are outlined. Author

08 COMPUTERS

Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics

N71-23206*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
OPERATIONS AND FACILITIES
In its The Deep Space Network, Vol. 1 15 Apr. 1971 p 145-181 refs (See N71-23206 12-11)
Avail: NTIS CSCL 05B

Deep Space Network (DSN) operations and engineering progress is presented on: (1) DSN traceability and reporting program; (2) teletype discipline of data transfer designed for support of Mariner Mars 1971 missions; (3) Deep Space Instrumentation Facility (DSIF) uplink amplitude instability measurement; (4) processed data combination for telemetry improvement-DSS 62; and (5) status of overseas DSIF 64-m diameter steerable paraboloid tracking antenna construction. A.L.

N71-23208*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
REAL TIME STATISTICAL TIME SERIES ANALYZER FOR SPEECH SEGMENTATION
Carrington H. Stewart (M.S. Thesis – Houston Univ.) Apr. 1971 77 p refs
(NASA-TM-X-58058) Avail: NTIS CSCL 09B

The procedure known as moment analysis of the reciprocal zero crossing distances of speech is discussed. This procedure is advanced through the design and construction of a real-time statistical time-series analyzer to eliminate the need for computer analysis. A discussion of the design concepts and design feasibility is presented. It is shown that the design concept is feasible and that the analyzer design is physically realizable, illustrating that the need for computer analysis to study and utilize the most promising aspect of the segmentation procedure is essentially eliminated. Author

N71-23222# Illinois Univ., Urbana. Coordinated Science Lab.
PHOTOCHROMIC MEMORY FOR COMPUTER APPLICATIONS Quarterly Progress Report, Oct. – Dec. 1970
H. W. Knoebel and H. V. Krone Jan. 1971 3 p ref
(Contract N00014-67-A-0305-0015)
(AD-718392) Avail: NTIS CSCL 9/2

Activity during this period has centered around the development of an improved technique for reading stored information from the memory system. A new technique has been developed that gives a much improved signal to noise ratio and makes possible the reading and regeneration of the stored information during a single light pulse. The improved discriminator system makes use of a beam splitter to divide the read light pulse between two photodetectors. Author (GRA)

N71-23296* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COMPARATOR FOR THE COMPARISON OF TWO BINARY NUMBERS Patent
Tage O. Anderson and Warren A. Lushbaugh, inventors (to NASA) Issued 25 Jun. 1968 (Filed 22 Oct. 1965) 6 p Cl. 340-146.2 Sponsored by NASA
(NASA-Case-XNP-04819; US-Patent-3,390,378;
US-Patent-Appl-SN-502701) Avail: US Patent Office CSCL 09B

A full comparator is discussed for two n bit numbers A and B. It includes n pairs of NAND gates. Each pair, which consists of first and second gates is associated with a different bit order. Each of the n first gates has only two inputs, while the number of inputs of each second gate varies from two for the second gate of the highest order to $2+(n-1)$ for the second gate of the lowest order. The gates are connected so that all the n first gates produce the same output when A is > or = to B, while all the gates of the second group produce the same output when A < or = to B. The outputs of the n second gates are combined in a first output gate while the outputs of all the n first gates and the output of the first output gate are combined in a second output gate. The relative magnitudes of A and B are indicated by the outputs of the first and second output gates.
Official Gazette of the U.S. Patent Office

N71-23331*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SUFFER: A PROGRAM FOR CONSOLE EXECUTION OF UTILITY PROGRAMS
John S. Cavallini and Dennis M. Giblin Feb. 1971 31 p
(NASA-TM-X-65501; X-603-71-144) Avail: NTIS CSCL 09B

SUFFER, System Utility Facility For Easy Recovery, is a systems program written for use on IBM S/360 computers. It allows the composition and execution of utility programs at any operator's console. Associated with SUFFER are procedure and control statement libraries. SUFFER's value, use, logic flow and installation are discussed. Examples and source listings are included. Author

N71-23332# New York Univ., N.Y. School of Engineering and Science.
COMPUTER ASSEMBLY TESTERS
Henry S. Lax Feb. 1971 115 p refs
(Contract N00039-68-C-3579)
(AD-718379) Avail: NTIS CSCL 9/2

An examination of available test equipment for computer assemblies has shown that one basic device exists which is common to all such test equipment. It is the Digital Signal Generator (DSG). The DSG is a programmable pulse generator whose pulse trains are used to generate the digital data for testing all kinds of computer assemblies. For the particular purpose of testing computer memories, the DSG generates variable data patterns and addresses the memory cells sequentially, in a random mode, collectively or selectively. The discriminators then compare responses with the original data on a bit-by-bit, word-by-word basis. The discriminators furnish a go/no-go indication according to prestored threshold levels. The report provides information representative of test equipment from various manufacturers, a listing of military test equipment, and a tabulation according to tester types in order to facilitate the selection of suitable test equipment. Author (GRA)

N71-23435*# Syracuse Univ., N.Y.
COMPUTER ENHANCEMENT THROUGH INTERPRETIVE TECHNIQUES Semiannual Status Report
Garth H. Foster [1970] 12 p refs
(Grant NGR-33-022-125)
(NASA-CR-117901) Avail: NTIS CSCL 09B

A study is reported aimed at the improvement in the usage of the digital computer through utilization of the technique of interpretation rather than the compilation of higher ordered languages. The rationale of the study is that there are three areas where interpretive techniques could enhance the performance of computers. The first would be in those instances where interpreters could beat compilers in execution speeds. The second way in which utility could be provided by interpreters is that of trading machine cycles in execution speed for space in the run time code stream. The third way would be if the implementation of an interpreter of a given language provides more effective use of programmer time in the development of software and for problems which are to be run once or only a very few number of times. Author

N71-23444# Joint Publications Research Service, Washington, D.C.
COMPUTER DEVELOPMENTS AND PROSPECTS
V. Glushkov 6 Apr. 1971 16 p Transl. into ENGLISH from Nauka i Zhizn (Moscow), no. 2, 1971 p 59 – 64
(JPRS-52809) Avail: NTIS

The development of universal computers and their applications in automating and processing information in certain fields of industry and economy are outlined. Author

N71-23445# Union Carbide Corp., Oak Ridge, Tenn. Computing Technology Center.
RADIATION SHIELDING INFORMATION CENTER. PROGRAM SETUP INSTRUCTIONS MANUAL
J. G. Jones and R. O. Green 15 Dec. 1970 108 p refs

(Contract W-7405-ENG-26)
(CTC-INF-1017) Avail: NTIS

The following information is included: document update and SDI program, SDI edit program, document edit program, customer update program, customer search program, authority file creation program, and MT/ST conversion program. NSA

N71-23490# Los Alamos Scientifc Lab., N.Mex.
SOME ELEMENTARY ATTEMPTS AT NUMERICAL MODELING OF PROBLEMS CONCERNING RATES OF EVOLUTIONARY PROCESSES
R. Schrandt and S. Ulam Dec. 1970 9 p refs
(Contract W-7405-eng-36)
(LA-4573) Avail: NTIS

An abbreviated account of calculations concerning the rates of evolution by a severely stylized and over simplified method is presented. The radio at which favorable mutations spread throughout the population subject to a survival of the fittest mechanism is emphasized. Author

N71-23594# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.
REMOTE DATA STATION INTERFACE TO THE PRODUCTION CONTROL COMPUTER
G. L. Bowers, D. W. Carver, C. M. Davenport, J. P. Falcon, and A. E. Stephens 20 Jan. 1971 35 p ref
(Contract W-7405-eng-26)
(Y-1748) Avail: NTIS

The feasibility of using a large computer for solving data problems on a real time basis is investigated. Results show a nondestructive test station was successfully interfaced to a CDC 3300 computer. Sufficient hard wired circuitry was provided to automate the testing sequence while the computer acquired and analyzed the data and reported the results to the remote station. Author

N71-23614# Illinois Univ., Urbana. Dept. of Computer Science.
ARITHMETIC UNIT OF ILLIAC 3: SIMULATION AND LOGICAL DESIGN, PART 2
Ping L. Koo, Daniel E. Atkins, and Lakshmi N. Goyal, ed. 10 Nov. 1970 165 p Revised
(Contract AT(11-1)-2118)
(COO-2118-2; Rept-418) Avail: NTIS

The arithmetic unit (AU) is being simulated to the hardware level of detail. The simulation is written in PL/1 for the IBM 360/75 computer. It also serves as a dynamic documentation for the logical design of AU. All registers and indicators are simulated as bit strings; all counters are simulated as fixed point number; all gating functions are simulated as procedures and grouped into one subprogram. The Sign-Digit Subtractor (SDS) and propagation logic are simulated as two subprograms. Every arithmetic order is simulated as one subprogram (including functional sub-blocks, such as one subprogram (including functional sub-blocks, such as quotient selector, multiplier recoder, etc.). This simulator, therefore, is composed of one main program and several subprograms. Every routine will be explained in detail in the following sections. A summary of the registers, counters and indicators used is given. Author

N71-23631# Army Missile Command, Redstone Arsenal, Ala. Metrology and Calibration Center.
STANDARDS LABORATORY APPLICATIONS OF A COMPUTER-AUTOMATED SYSTEM
Frederick B. Seeley *In* NBS Innovative Metrology: Key to Progr Mar. 1971 p 29 34 refs (See N71-23626 12-14)
Avail: SOD $1.50

A computer-automated calibration system whose accuracy and precision make it suitable for standards laboratory applications is described. The system was applied to electrical, radio frequency, electro-optical, and electro-mechanical measurements. Results are summarized that include saturated standard cell, standard resistor, resistance thermometer, micropotentiometer, and attenuator calibrations. Additional topics include the experience in computer programming, reliability, and systems operation. Author

N71-23666*# Martin Marietta Corp., Denver, Colo.
LONGITUDINAL PROPULSION COUPLING SYSTEM VOLUME 2: DIGITAL COMPUTER SOLUTION TO EQUATIONS OF MOTION
Ronald W. Johnson Mar. 1971 98 p refs
(Contract NAS8-25054)
(NASA-CR-103101; MCR-71-80) Avail: NTIS CSCL 09B

The computer program for the development of an analytical tool to predict the POGO characteristics associated with powered flight of liquid propelled launch vehicles is reported. The longitudinal and lateral structural oscillations, known as POGO oscillations, are the result of a closed loop response involving the launch vehicle structure, the propellant feedlines, the pump characteristics, and the propulsion system. The program solves responses of the variables about a nominal, steady state operating condition. This means that, in the absence of an external forces, any transient response should die out unless self excitation occurs. Author

N71-23667# Royal Aircraft Establishment, Farnborough (England).
THE DETERMINATION AND AUTOMATIC CORRECTION OF DATA ERRORS USING THE TELEFUNKEN COMPUTER, TR4 [TELEFUNKEN-RECHNER TR4 ERMITTELT UND KORRIGIERT AUTOMATISCH MESSDATENFEHLER]
Werner Busch Dec. 1970 17 p ref Transl. into ENGLISH from Tech. Mitt. AEG-Telefunken (W. Germany), no. 4, 1969 p 26-31
(RAE-Lib-Trans-1544) Avail: NTIS

A process, suitable for computer use, is described for the detection and correction of errors in data points which are the realization at equal distant intervals of an underlying smooth function. The method used is based on three test parameters which are functions of the third differences of the data. An ALGOL program is given for computer implementation of the process. Author

N71-23804# Grand Junction Office (AEC), Colo.
ELIPGRID: A FORTRAN 4 PROGRAM FOR CALCULATING THE PROBABILITY OF SUCCESS IN LOCATING ELLIPTICAL TARGETS WITH SQUARE, RECTANGULAR, AND HEXAGONAL GRIDS Final Report
Donald A. Singer [1970] 30 p refs
(Contract AT(05-1)-918)
(GJO-918-4) Avail: NTIS

Given the size and shape of an existing or hypothetical elliptical target, the ELIPGRID program calculates the probability of locating it with any size of square, hexagonal, or rectangular grid. The program determines the probability for a randomly oriented target or a target with a specific orientation with respect to the grid. Tabulated probabilities are given which demonstrate the importance of comparing the grid types since the differences in the probabilities for equal cost grids can at times be great. Author

N71-23862# Arizona Univ., Tucson. Department of Electrical Engineering.
PUBLICATIONS OF THE COMPUTER SCIENCE RESEARCH LABORATORY, 1969 1970
1970 88 p refs *Its* EES Series, Report No. 9
(Rept-29-7-70-400) Avail: NTIS

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9. A PROPOSED HYBRID COMPUTER METHOD FOR FUNCTIONAL OPTIMIZATION G. A. Korn and H. Kosako (Osaka Univ.) p 64–68 refs (See N71-23871 12-08)

10. SAMPLED DATA RECONSTRUCTION ERRORS J. V. Wait p 68–70 refs (See N71-23872 12-08)

11. NONLINEAR LEAD COMPENSATOR W. P. Jenney p 71–73 refs (See N71-23873 12-10)

12. AN INTEGRATED LINEAR TRANSCONDUCTANCE ANALOG MULTIPLIER M. G. Free (Motorola Inc., Phoenix, Ariz.) p 74–82 refs (See N71-23874 12-08)

13. COMPUTER AIDED DESIGN OF FIXED POINT DIGITAL FILTERS J. H. Puls and J. V. Wait p 84–88 refs (See N71-23875 12-08)

N71-23863# Arizona Univ., Tucson.

PROJECT DARE: DIFFERENTIAL ANALYZER REPLACEMENT BY ON-LINE DIGITAL SIMULATION

Granino A. Korn *In its* Publ. of the Computer Sci. Res. Lab., 1969–1970 1970 p 2–12 refs (See N71-23862 12-08)

(Grants NSF GK-1860; NSF GK-15224)

Avail: NTIS

Project DARE demonstrates economical and convenient all-digital on-line simulation of dynamical systems. DARE 1 is a flexible CSSL-type floating point system running on the PDP-9 computer. DARE 2 is a block-oriented, relatively fast fixed point system permitting real time flight simulation on the small PDP-9. DARE 3 and 4 will implement fast floating point on-line simulation on a time-shared CDC 6400. Each DARE system adds a simulation console to a small or large digital computer and can replace conventional analog computation in many applications. System equations or block statements are entered and edited on a CRT typewriter. Solutions appear on a second CRT display and can also be plotted or printed for report preparation. Iterative and statistical simulation studies are also possible. Author

N71-23864# Arizona Univ., Tucson. Dept. of Electrical Engineering.

DARE 2: FAST ON-LINE DIGITAL SIMULATION ON A SMALL COMPUTER

Thomas A. Liebert *In its* Publ. of the Computer Sci. Res. Lab., 1969–1970 1970 p 13–21 refs Sponsored by NSF (See N71-23862 12-08)

Avail: NTIS

DARE 2 is a remarkably fast, on-line, all-digital, block diagram-based simulation system which adds a convenient and inexpensive simulation console to a PDP-9 computer. Block statements, control logic, tabular functions, and data are entered and edited on a CRT keyboard. Solutions appear on a second CRT display and can be plotted or printed out for report preparation. A fully commented program and solution record can be printed out on a teletype and programs may be stored on punched paper tape to be run again at a later date. The DARE 2 system can be easily programmed to make optimal use of the computer, generating a much faster program than a FORTRAN compiler. Author

N71-23865*# Arizona Univ., Tucson. Computer Science Research Lab.

TABLE-LOOKUP/INTERPOLATION FUNCTION GENERATION FOR FIXED POINT DIGITAL COMPUTATIONS

H. M. Aus and G. A. Korn *In its* Publ. of the Computer Sci. Res. Lab., 1969–1970 1970 p 22–26 refs (See N71-23862 12-08)

(Grant NsG-646)

(NASA-CR-118010) Avail: NTIS CSCL 09B

For very fast function generation with small fixed point digital computers, the n-bit argument word x is split into an N-bit word representing the breakpoint abscissa S sub i for table-lookup by indirect addressing, and an n-N bit word representing the interpolation difference X-X sub i. The complete procedure takes only about 50 machine cycles for equal breakpoint intervals, and about 70 machine cycles for variable breakpoint density. A sine-cosine generator for digital or hybrid computer simulation is exhibited as an example. Author

N71-23866# Arizona Univ., Tucson. Dept. of Electrical Engineering.

DIFFE: AN ON-LINE DIFFERENTIAL EQUATION SOLVING ROUTINE WITH AUTOMATICALLY SCALED DISPLAY

A. Trevor and J. V. Wait *In its* Publ. of the Computer Sci. Res. Lab., 1969–1970 1970 p 27–33 refs (See N71-23862 12-08)

(Grants NSF GK-1860; EES-46-67)

Avail: NTIS

A FORTRAN 4 digital computer program for solving ordinary differential equations is described. Two versions are described; one without graphical display for use in standard batch processing, and a second version written for the DEC PDP-9 and featuring a self-scaling display-driving subroutine (for scope or plotting board) and on-line keyboard entry. Author

N71-23867*# Arizona Univ., Tucson.

A NEW GRAPHIC DISPLAY/PLOTTER FOR SMALL DIGITAL COMPUTERS

Granino A. Korn, Stevens Simons, Russell Steinbach, and Claude A. Wiatrowski *In its* Publ. of the Computer Sci. Res. Lab., 1969–1970 p 35–44 refs (See N71-23862 12-08)

(Grants NsG-646; NSF GK-1860)

(NASA-CR-118011) Avail: NTIS CSCL 09B

A new inexpensive cathode ray tube display and recorder interface designed to provide graphical output for many of the increasingly small digital computers in the 12- to 24-bit class is described. The original design was developed to produce differential equation solutions, phase-plane plots, correlation functions, spectra, and amplitude distributions for on-line digiral simulation with the 18-bit PDP-9, but the interface logic is flexible enough to serve many other computers and applications. The entire cost of the display interface, when built with with DEC logic cards, is less than $1,900 exclusive of power supplies and display oscilloscope. The use of DED cards is convenient for interfacing with the PDP-9, but logic costs could be halved if the interface were assembled with integrated circuit logic. In this case, the entire display interface would fit on two or three logic cards. Author

N71-23868*# Arizona Univ., Tucson. Dept. of Electrical Engineering.

A COLOR-TELEVISION GRAPH PLOTTER FOR DIGITAL COMPUTERS

Claude A. Wiatrowski *In its* Publ. of the Computer Sci. Res. Lab., 1969 - 1970 p 45 - 48 refs Supported by NASA (See N71-23862 12-08)
(NASA-CR-118015) Avail: NTIS CSCL 09B

The color television graph plotter is not a substitute for a graphic display, but a useful adjunct. This unit requires no digital to analog converters, uses a standard television monitor as an output device, and is not difficult to construct or adjust. It completely eliminates the usual difficulties encountered when using coordinate data to provide analog positioning voltages for a display. The graph plotter version provides a color display of one to four single-valued functions on a standard color television monitor. The resolution of the Y-coordinate is eight bits and may be easily expanded to nine. A hardware graticule generator permits display of a coordinate grid under program control. The program may select the color of each of the four traces, the graticule, and the background. The colors red, green and blue, and all combinations of them are available. Author

N71-23869*# Arizona Univ., Tucson.
SIMULATION OF A CLASSICAL DETECTION PROBLEM: DETECTION OF A PHASE COHERENT RF PULSE TRAIN UNKNOWN PHASE IN ADDITIVE GAUSSIAN NOISE
J. E. Belt and Cliff A. Harris *In its* Publ. of the Computer Sci. Res. Lab., 1969 - 1970 p 50 - 53 refs (See N71-23862 12-08)
(Grant NsG-646)
(NASA-CR-118012) Avail: NTIS CSCL 17B

A hybrid computer simulation of a simple signal detection problem is described. A signal of unknown phase plus white Gaussian noise is detected with a correlation receiver. Measured detection probabilities and false alarm probabilities for various signal to noise ratios are compared to the theoretical curves for the Bayes optimum receiver. Good results are obtained using a low cost educational computer, APE 2. Author

N71-23870# Arizona Univ., Tucson. Dept. of Electrical Engineering.
A MONTE CARLO TECHNIQUE USING A FAST REPETITIVE ANALOG COMPUTER FOR DETERMINING LOWEST EIGENVALUES OF PARTIAL DIFFERENTIAL EQUATIONS FOR VARIOUS BOUNDARIES, WITH APPLICATIONS
Richard T. D'Aquanni *In its* Publ. of the Computer Sci. Res. Lab., 1969 - 1970 p 54 - 63 refs (See N71-23862 12-08)
Avail: NTIS

Described are: (1) A Monte Carlo technique for estimating the lowest eigenvalues of certain elliptic and hyperbolic partial differential equations with Dirichlet boundary conditions. (2) A stochastic process whose output conditional probability density distribution satisfies a partial differential equation similar to the partial differential equation under consideration is, along with the boundary conditions, implemented on ASTRAC 2, a fast repetitive analog computer. Eight different boundaries on the scalar Helmholtz equation in one, two, and three-dimensional space were implemented. Each of the resulting eight lowest eigenvalue estimates was then compared to its corresponding and expected true lowest eigenvalue. Computer hardware errors, along with the error resulting from the mathematical approximation employed in deriving the estimate, are indicated. Corrective measures are included when necessary. Applications result from a presentation of analogies relating the partial differential equations under consideration to partial differential equations modeling physical processes. Author

N71-23871*# Arizona Univ., Tucson. Dept. of Electrical Engineering.
A PROPOSED HYBRID COMPUTER METHOD FOR FUNCTIONAL OPTIMIZATION
Granino A. Korn and H. Kosako (Osaka Univ.) *In its* Publ. of the Computer Sci. Res. Lab., 1969 - 1970 p 64 - 68 refs (See N71-23862 12-08)
(Grant NsG-646)
(NASA-CR-118013) Avail: NTIS CSCL 09B

To obtain successively improved control variable functions (k)u(t), it is proposed that a random perturbation delta u(t) be added to (k)u(t). A fast analog computer run then solves the dynamical system equations and computes the given criterion function. If the latter has been improved, then (k+1)u(t) = u(t) + delta u(t) is stored digitally for the next iteration; otherwise delta u(t) is discarded and a new control perturbation is tried. Author

N71-23872# Arizona Univ., Tucson.
SAMPLED DATA RECONSTRUCTION ERRORS
John V. Wait *In its* Publ. of the Computer Sci. Res. Lab., 1969 - 1970 1970 p 68 - 70 refs (See N71-23862 12-08)
Avail: NTIS

Reconstruction errors based on sampling of data resulting from reconversion of digital output to analog form are investigated. Reconstruction filters and ideal reconstruction operator characteristics are described. Sampling rates must be related to the accuracy and ease of data reconstruction, as well as the spectral characteristics of the original signal. Reconstruction errors can be predicted if the analog signal required to drive the hold circuit is obtained in an interval negligible compared to sampling time. Reconstruction of sine waves and statistical averaging techniques for estimation of average rms error in reconstruction are described. A.L.

N71-23874*# Arizona Univ., Tucson.
AN INTEGRATED LINEAR TRANSCONDUCTANCE ANALOG MULTIPLIER
Maurice George Free (Motorola Inc., Phoenix, Ariz.) *In its* Publ. of the Computers Sci. Res. Lab., 1969 - 1970 1970 p 74 - 82 refs (See N71-23862 12-08)
(Grant NsG-646)
(NASA-CR-118014) Avail: NTIS CSCL 09B

A solid state, monolithic integrated analog multiplier, based on the controlled transconductance principle that is designed for high speed, high accuracy, and excellent linearity is described. A novel differential amplifier circuit permits cancellation of undesired nonlinearities, and carefully matched device geometries account for the good accuracy of the new multiplier. With an inherent voltage gain of A sub v = 1/10, the multiplier will provide a + or - 10 V output at + or - 10 mA with linearity approaching 0.1% at 100 Hz. The multiplier package may be used in conjunction with an external operational amplifier and external resistors, and offers the advantages of monolithic construction (low cost excellent temperature tracking) with the precision of adjustable parameter, discrete construction. Author

N71-23875# Arizona Univ., Tucson. Dept. of Electrical Engineering.
COMPUTER AIDED DESIGN OF FIXED POINT DIGITAL FILTERS
James H. Puls and John V. Wait *In its* Publ. of the Computer Sci. Res. Lab., 1969 1970 1970 p 84 88 refs (See N71-23862 12-08)
(Grants NSF GK-1860; EEE-111-69) Avail: NTIS
Avail: NTIS

An on-line interactive program used to empirically determine the performance of fixed point digital filters is described. The program simulates direct, cascade and parallel representations of up to tenth order and with up to thirty-six bits of precision. As a beginning phase of the study, the program develops discrete time filter algorithms based upon a continuous time prototype filter, using one of five hold-invariant methods. Next a simulation of the digital filter is done twice, first with thirty-six bits precision in the calculations, which is used as a standard, then a selectable shorter word length. Using a variety of input forcing functions, including random signals, the filter outputs are compared, and errors

computed. Test results permit distinguishing between errors due to numerical approximations and due to round-off. Author

N71-23885# Air Force Systems Command, Wright-Patterson AFB, Ohio. Flight Dynamics Lab.
COMPUTER SIMULATION OF A SEMIACTIVE THERMAL CONTROL SYSTEM Technical Report, Jan. 1968–Jan. 1970
E. A. Zara Nov. 1970 108 p
(AD-718092; AFFDL-TR-70-103) Avail: NTIS CSCL 22/2

A space mission was simulated to measure the thermal performance of an actual, hardware, thermal management system. The system performance was then compared with the thermal performance predicted by a computer program which analytically describes the hardware system. The hardware system is a semiactive thermal control system and the computer program is a modified version of the IBM 7094 Lockheed Thermal Analyzer Program. The space mission simulation consists of various heat load schedules for the system and a duplication of the space thermal environment. The analytical representation of the hardware system involves thermal, flow, and servo analyses. The results obtained demonstrate that the analytical representation of the actual system was accurate within 5% of measured system performance. Author (GRA)

N71-23915*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NUMERICAL SOLUTION OF THE UNSTEADY NAVIER-STOKES EQUATIONS AND APPLICATION TO FLOW IN A RECTANGULAR CAVITY WITH A MOVING WALL
Leo F. Donovan Washington Apr. 1971 58 p refs
(NASA-TN-D-6312; E-5577) Avail: NTIS CSCL 20D

A computer program to solve the two dimensional, incompressible Navier-Stokes equations was written in FORTRAN IV. The program was used to investigate the startup of flow inside a cavity with the upper wall moving at constant velocity. Results are given for rectangular cavities with aspect ratios of 1/2 and 2 at a Reynolds number of 100 and for square cavities at Reynolds numbers between 100 and 500. The unsteady results at large times are compared where possible to velocities calculated from the steady Navier-Stokes equations and to the results of steady experiments; good agreement is shown. In addition, a numerical flow visualization technique is described and used to make a motion picture showing the results of the calculations. Author

N71-23916# RAND Corp., Santa Monica, Calif.
SOVIET CYBERNETICS REVIEW, VOLUME 4, NUMBER 9, 1970
Wade B. Holland, ed. Nov. 1970 87 p refs
(Contract F44620-67-C-0045)
(AD-718404; RM-6200/9-PR) Avail: NTIS CSCL 9/2

The document reports on the sale by ICL of four of its System-4 configurations to the Soviets. The total value of all systems is estimated at nearly $5.7 million. Illustrative of the Soviet reporting on the ASVT computers is an article detailing the specifications of the three ASVT machines, the M-1000, M-2000, and M-3000. Detailed descriptions of two computers in the Minsk series are included in this issue--the Minsk-22, probably the most widely used machine in the USSR, and the Minsk-32, the newest model in the series. An article covering an interview with a leading cybernetician, G. S. Pospelov, reveals his theory of designing control systems and his support of the Glushkov position concerning organization of multilevel control and management systems. Computing activities in two Soviet republics and in Hungary are the subjects of several other articles. Author (GRA)

N71-24023*# Rand Corp., Santa Monica, Calif.
COMPUTER PERFORMANCE ANALYSIS: MEASUREMENT OBJECTIVES AND TOOLS
T. E. Bell Feb. 1971 39 p refs
(Contracts NAS12-2144; F44620-67-C-0045I Proj. Rand)
(NASA-CR-118037; R-584-NASA/PR) Avail: NTIS CSCL 09B

Recognizing objectives and choosing measurement tools are two important steps in a performance analysis study. Modeling, choosing a data collection mode, experimental design, and data analysis deserve at least as much attention as examining data collection tools. Author

N71-24024# Stanford Univ., Calif. Dept. of Computer Science.
COMMUNICATING SEMAPHORES
Harry J. Saal and William E. Riddle Feb. 1971 21 p refs
(Contracts AT(04-3)-515; AT(04-3)-326)
(SU-STAN-CS-71-202) Avail: NTIS

Two extensions to the semaphore operators originally introduced by Dijkstra are described. These extensions can be used to reduce: (1) the number of semaphore references; (2) the time spent in critical sections; and (3) the number of distinct semaphores required for proper synchronization without greatly increasing the time required for semaphore operations. Communicating semaphores are utilized not only for synchronization but also for message switching, resource allocation from pools and as general queueing mechanisms. Author

N71-24217# Academy of Sciences (USSR), Moscow.
DYNAMIC SYNTHESIS OF AUTOMATIC CONTROL SYSTEMS
V. A. Besekerskiy Nauka 1970 376 p refs In RUSSIAN
/ts Theoret. Fundamentals of Cybernetics Eng., No. 583
Avail: NTIS HC$6.00/MF$0.95

Automatic control system synthesis is examined in terms of predetermined requirements of accuracy and basic dynamic characteristics. Methods are developed for optimum synthesis in agreement with specified performance criteria. A particular functional in the frequency region is used to evaluate the simplicity of system design. The functional defines the essential characteristics of the projected control channel. Also considered are computation methods for a broad range of automatic control systems (e.g., servo-systems, systems for reproducing and stabilizing rotation rates, production control systems, and gyrostabilizers). Emphasis is given to computerized automatic control systems. Transl. by E.C.

N71-24218# Academy of Sciences (USSR), Moscow.
DESIGN PROBLEMS IN INDUSTRY AUTOMATIC CONTROL SYSTEMS
N. P. Fedorenko, ed. 1970 256 p refs In RUSSIAN
Avail: NTIS

Four basic issues in the generation of an industry-wide automatic control system are considered: (1) economic factors, (2) mathematical provisions, (3) information system aspects, and (4) engineering factors. Classifying and grouping industries in accordance with common technological and economic organizations is discussed along with control mechanisms, optimum methods for plan calculations, procedures for operations decision making, and processes for formulating accounting and reporting indicators. Transl. by E.C.

N71-24220# Academy of Sciences (USSR), Moscow. Inst. of Philosophy.
COMPLEX LOGIC (THEORY OF LOGICAL SEQUENCING)
A. A. Zinovyev 1970 203 p refs In RUSSIAN
Avail: NTIS

A formal apparatus developed using complex logic is described. The discussion covers a general theory of deduction and its expansion to include a theory of predication, quantifiers, conditional forms, modality, existence, terms, relationships, and physical sequencing. Proofs are given of the consistency and completeness of a complex logic system in terms of specific semantic

interpretations. The role of classical and intuitional logic in logical sequencing theory is discussed. Transl. by E.C

N71-24221# Academy of Sciences (USSR), Moscow. Siberian Energy Inst.
SYNTHESIS OF MULTIDIMENSIONAL AUTOMATIC CONTROL SYSTEM USING COMPUTERS
R. I. Ivanovskiy and A. G. Taranov 1970 172 p refs In RUSSIAN
Avail: NTIS

Methodological and algorithmic considerations in the synthesis of linear, multidimensional, automatic control systems are discussed. The sequential stages of the synthesis are examined along with matrix algorithms for calculating system characteristics. Consideration is given to stability of multidimensional systems and a method is presented for computing the origins of complex operator expressions. A method is also described for computerized approximation of transfer functions. Transl. by E.C.

N71-24325# Massachusetts Inst. of Tech., Cambridge.
PROJECT INTREX. Semiannual Activity Report, 15 Sep. 1970 - 15 Mar. 1971
15 Mar. 1971 89 p refs Sponsored by Carnegie Corp., Council on Library Resources, Inc., NSF, and Office of Educ.
(Intrex-PR-11) Avail: Issuing Activity

Research and development activities, and initial use of the model library are reported. Retrieval system usage experiments and analysis of the usage are described. Augmented catalog inputting, extensive documentation of Intrex software, testing of a second display console, full-text storage and retrieval, and cost analysis of the Intrex system are outlined. Evaluations of film strips explaining the use of the model library are presented. Recent Pathfinders, or searching aids, and results of questionnaires sent to users on the value of the Pathfinders are given. N.E.N.

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N71-23188* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
POSITIVE dc TO POSITIVE dc CONVERTER Patent
Eugene H. Berry and Frank J. Nola, inventor (to NASA) Issued 30 Sep. 1969 (Filed 12 Jan. 1968) 4 p Cl. 321-2; Int. Cl. H02m3/22. 5/40
(NASA-Case-XMF-14301; US-Patent-3,470,446;
US-Patent-Appl-SN-697341) Avail: US Patent Office CSCL 10B

An apparatus for converting the output of a positive dc voltage source to a positive dc voltage of lower magnitude across a load having a common reference point with the source including a plurality of capacitors connection in series by first half wave rectifier means and in parallel by second half wave means is described. The apparatus has first and second order transistor switch means extends between the positive output terminal of the dc source and a first load input terminal. The switch is use to alternately connect one end of the capacitor circuit to the positive output terminal and to the first load input terminal, and conducting means coupling the opposed end of the capacitor circuit to the negative terminal of the dc source and to the second load input terminal. Author

N71-23189* Radio Corp. of America, New York.
METHOD OF ERASING TARGET MATERIAL OF A VIDICON TUBE OR THE LIKE Patent
James John Hawley, inventor (to NASA) Issued 4 Mar. 1969 (Filed 27 Jun. 1967) 4 p Cl. 315-26; Int. Cl. H01j29/70 Sponsored by NASA
(NASA-Case-XNP-06028; US-Patent-3,431,460;
US-Patent-Appl-SN-649356) Avail: US Patent Office CSCL 09E

A method and means for shortening the time required to erase target material of a storage tube which retains a spatial charge density pattern for a relatively long time is described. After reading a pattern on the target material, the material is exposed to a uniform light to rapidly discharge the target material and remove the original pattern. After which the beam is deflected at rates outside the systems readout bandwidth. Consequently, the material is recharged for subsequent exposure in a relatively short time with a pattern which does not affect the tube's readout system. Official Gazette of the U.S. Patent Office

N71-23190* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ELECTRONIC CATHODE HAVING A BRUSH-LIKE STRUCTURE AND A RELATIVELY THICK OXIDE EMISSIVE COATING Patent
William R. Kerslake, inventor (to NASA) Issued 26 Nov. 1968 (Filed 24 Jan. 1966) 3 p Cl. 313-231
(NASA-Case-XLE-04501; US-Patent-3,413,510;
US-Patent-Appl-SN-522794) Avail: US Patent Office CSCL 09E

A cathode electrode formed by a twisted wire stem having bristles extending radially is described. The wire and bristles may be of iridium and/or tungsten, tantalum, molybdenum, or platinum. The bristles and stem are coated with barium oxide or preferably a mixture of barium-strontium-calcium oxides.
Official Gazette of the U.S. Patent Office

N71-23191* Garrett Corp., Los Angeles, Calif.
DUAL LATCHING SOLENOID VALVE Patent
William C. McNutt and Hugh G. Odell, inventors (to NASA) Issued 3 Dec. 1968 (Filed 28 Jun. 1967) 5 p Cl. 137-554 Sponsored by NASA
(NASA-Case-XMS-05890; US-Patent-3,414,012;
US-Patent-Appl-SN-650166) Avail: US Patent Office CSCL 09A

A solenoid operated valve assembly which is capable of controlling the flow of more than one fluid, and which can be latched in either an open or a closed position without using continuous electrical power is described. A highly stable valve assembly is provided which is virtually unaffected by vibrations, accelerations, or shock loads. Author

N71-23270* Westinghouse Electric Corp., Pittsburgh, Pa.
PULSE MODULATOR PROVIDING FAST RISE AND FALL TIMES Patent
Martin G. Woolfson, inventor (to NASA) Issued 17 Dec. 1968 (Filed 23 Dec. 1965) 4 p Cl. 307-263 Sponsored by NASA
(NASA-Case-XMS-04919; US-Patent-3,417,266;
US-Patent-Appl-SN-516155) Avail: US Patent Office CSCL 09E

A pulse generator comprising a storage capacitor charged for a source of positive voltage and connected in series with the collector and emitter of an input switching transistor, and a silicon controlled rectifier which provides a current rectifier is connected between the emitter of the input transistor and ground to provide an alternate current path. A second switching transistor is coupled to the cathode of the second silicon rectifier and the base of the input switching transistor. A voltage start pulse source is coupled to the gate of the first silicon rectifier and a stop pulse voltage source is coupled to the gate of the second silicon rectifier. When the switching transistor turns on, the input transistor is turned off which removes the anode currents from the silicon rectifiers and rendering the silicon rectifiers and the switching transistor nonconductive, thereby reducing power consumption to zero during quiescent conditions. Official Gazette of the U.S. Patent Office

N71-23306# Collins Radio Co., Cedar Rapids, Iowa.
INTEGRATED HIGH FREQUENCY ANTENNA SYSTEM Final Report, 13 Nov. 1969 - 9 Nov. 1970
David M. Jaksa and Jeffrey S. Yelowitz Nov. 1970 259 p refs
(Contract N62269-70-C-0016)
(AD-718167; Rept-523-0763421-00111M) Avail: NTIS CSCL 9/5

The objective of the integrated high-frequency antenna system (IHFAS) program is to provide a simultaneous operation (SIMOP) capability for the P-3 hf communication system. This capability will be provided for the P-3C, which will incorporate the higher hf transmitter powers and Link 11 data capability of A-NEW. A technique was developed to optimize transmit filters. This technique enables analysis of system parameters to determine detailed requirements for an optimum high-level transmit filter. A series of tests were performed on the AN/ARC-132(V) hf transceiver to aid in evaluating it as a SIMOP radio. General performance tests were conducted in accordance with applicable portions of MIL-STD-449C. In addition, external intermodulation, spurious voltage, and spurious impedance measurements were made. Author (GRA)

N71-23307# Michigan Univ., Ann Arbor. Dept. of Electrical Engineering.
NUMERICAL STUDIES IN COMPUTER-AIDED DESIGN Final Technical Report, 1 Sep. 1966 - 31 Dec. 1970
D. A. Calahan 28 Jan. 1970 29 p refs
(Grant AF-AFOSR-1217-67)
(AD-718152; AFOSR-TR-71-0106) Avail: NTIS CSCL 9/5

The specific projects studied were the following: Integration methods for solution of the large systems of nonlinear ordinary differential equations that result from description of the transient behavior of digital computer switching circuits; Solution of large sparse systems of simultaneous linear equations that result from description of the quiescent (static) and transient behavior of nonlinear circuits; Effects of equation formulation on numerical solution; and, the Use of new sensitivity calculation methods to (1) optimize the design of gate-sized switching circuits, and (2) improve model accuracy of semiconductor devices. Author (GRA)

N71-23311* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PASSIVE SYNCHRONIZED SPIKE GENERATOR WITH HIGH IMPUT IMPEDANCE AND LOW OUTPUT IMPEDANCE AND CAPACITOR POWER SUPPLY Patent
Ciro A. Cancro and Paul J. Janniche, Jr., inventors (to NASA) Issued 25 Jun. 1968 (Filed 22 Oct. 1965) 5 p Cl. 307-260
(NASA-Case-XGS-03632; US-Patent-3,390,282; US-Patent-Appl-SN-502739) Avail: US Patent Office CSCL 09E

A pulse generator for synchronizing or resetting electronic signals without requiring a separate external power source is described. A storage capacitor stores energy from incoming signals, such energy being utilized to power the pulse generator circuitry. By charging the storage capacitor, triggering a discharge circuit when the input pulse drops to a predetermined level, and developing the output pulse through an amplifier stage which is connected directly to said storage capacitor, the output pulse is rendered independent of the input pulse and the pulse generator needs no external power source. Official Gazette of the U.S. Patent Office

N71-23316* Sanders Associates, Inc., Nashua, N.H.
INCREASING EFFICIENCY OF SWITCHING TYPE REGULATOR CIRCUITS Patent
William M. Clapp, inventor (to NASA) Issued 17 Dec. 1968 (Filed 13 Jul. 1966) 5 p Cl. 323-22 Sponsored by NASA
(NASA-Case-XMS-09352; US-Patent-2,417,321; US-Patent-Appl-SN-564919) Avail: US Patent Office CSCL 09E

Constant voltage is applied to a load from a regulated power supply via a transistor switch in series connection with the primary winding of a transformer which directly couples the switch between the source and the load. A gating control network for the transistor series switch is connected by the transformer secondary to provide a dc path so that substantially all the current applied to the control network from the input power source is fed to the load. The control network includes a Schmitt trigger. The voltage across the switching transistor when it is conducting remains substantially constant despite variations in load current since the current in the control network is responsive to load current. The transformer inductive network functions as a current transformer to supply load current to the gating network. Efficiency is increased since the control network is in series with the source and the load. Official Gazette of the U.S. Patent Office

N71-23377# IIT Research Inst., Chicago, Ill.
AN ALGEBRAIC FORMULATION OF A MULTIPLE PATH PROBLEM IN A PLANAR GRAPH WITH TRIPLE CONNECTIVITY Technical Report, 15 Feb. 1970 - 15 Feb. 1971
Scott H. Cameron 22 Feb. 1971 19 p
(Contract N00014-70-C-0245)
(AD-718804) Avail: NTIS CSCL 9/5

The report presents a formulation of the single layer printed circuit wiring problem which, to the authors knowledge, is the only known approach other than complete enumeration of all combinations of all possible paths that will generate a solution, i.e., a set of disjoint paths, in every case where a feasible solution exists. Whether the improvement in computational efficiency relative to complete enumeration is sufficient to permit this formulation to provide the basis of a practical computational procedure is still unknown. Its practicality depends on the facility with which a certain set of simultaneous Boolean equations may be solved in cases of practical interest. Author (GRA)

N71-23383*# Bendix Corp., Sidney, N.Y. Electrical Components Div.
MATERIALS INVESTIGATION AND TESTS FOR THE DEVELOPMENT OF SPACE COMPATIBLE ELECTRICAL CONNECTORS Final Report, 1 Jun. - 30 Nov. 1970
C. A. Johnson, Carl Pomeroy, and R. W. Normann 18 Dec. 1970 62 p refs
(Contract NAS8-26054)
(NASA-CR-103092) Avail: NTIS CSCL 09A

Relevant literature, reports, papers, periodicals and suppliers data sheets were reviewed to select candidate metals, platings, rigid dielectrics and elastomers for use in future space compatible electrical connectors. Materials were selected in light of the extreme environment of earth originated space missions; atmospheric conditions including pressure, humidity and salt corrosion; reduced pressure high oxygen cabin conditions; space vacuum approaching 1×10 to the minus 10th power Torr, and temperature extremes from plus 200 C to minus 200 C. The mechanics of cold welding have been studied to aid the selection of metals and platings. The candidate organic materials have been selected for resistance to outgassing and flammability, as well as dielectric and mechanical properties. A test program is recommended to confirm the material selections. Author

N71-23443* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SUPERCONDUCTING ALTERNATOR Patent
John C. Fakan, inventor (to NASA) Issued 16 Jul. 1968 (Filed 28 Sep. 1965) 4 p Cl. 310-10
(NASA-Case-XLE-02823; US-Patent-3,393,332; US-Patent-Appl-SN-491058) Avail: US Patent Office CSCL 09E

A superconducting alternator is described which utilizes windings cooled below their critical temperature to form superconductors. The device includes a pair of spaced magnetic cores with field and

output windings, current switches, a flux commutator, and a shaft-rotating motor enclosed in a cryogenic fluid filled insulating container. J.M.

N71-23489# Naval Postgraduate School, Monterey, Calif.
A LOW IMPEDANCE HIGH CURRENT ULTRASONIC SIGNAL SOURCE FOR FERRORESONANCE STUDY
John Reynolds Pratchios (M.S. Thesis) Sep. 1970 37 p refs
(AD-718334) Avail: NTIS CSCL 9/5

In ferroresonant mode, a transformer is saturated and requires very high currents from the source. Previous studies of ferroresonance could not be performed effectively because of high internal impedance of the source. Introduction of transformers to improve these shortcomings would have also introduced undesirable inductive effects. In this thesis, a transistor voltage source with low internal impedance and high current delivering ability is designed and tested. The source is used to investigate an unsymmetrical mode of series resonance. Resonant circuit behavior is both qualitatively and quantitatively described. Author (GRA)

N71-23491# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FERRITE CORES FOR MAGNETIC HEADS WITH AN INCREASED RESISTANCE TO WEAR
A. S. Eisurovich 10 Nov. 1970 20 p refs Transl. into ENGLISH from Tr. Vses. Nauchn. Issled. Magnitnoi Zap. Tekhnologii Radioveshchaniya Televideniya (USSR), v. 15, no. 5, 1967 p 78-88
(AD-718692; FTD-HT-23-487-70) Avail: NTIS CSCL 9/1

The results of experimental work on the manufacture of nickel-zinc ferrite cores for video heads and data on the testing of protective glass coverings for increasing the head service life are introduced. For cores of various magnetic heads operating up to 10 MHz, nickel-zinc ferrites with the required electromagnetic parameters are proposed. Judgments on the structure of ferrites appropriate for the manufacture of magnetic heads have been presented. Encouraging results on the use of protective glass coatings for increasing the service life of video heads have been obtained. Henceforth, works in this direction will be presented. Author (GRA)

N71-23513# Technische Hochschule Carolo Wilhelmina, Brunswick (West Germany). Inst. fuer Elektrophysik.
FABRICATION AND INVESTIGATION OF THIN FILM STRUCTURES OF THE METAL-INSULATOR-METAL TYPE [HERSTELLUNG UND UNTERSUCHUNG VON DUENNFILMSTRUKTUREN DES TYPS METALL-ISOLATOR-METALL]
Peter Gawlik (Ph.D. Thesis) 1969 140 p refs In GERMAN
Avail: NTIS

Metal-insulator-metal thin film sandwich structures are increasingly used in microminiaturization as capacitors. The theory of tunnelling in these structures and the dependence of the tunnelling current on various parameters is discussed. The electron work function between the metal and the dielectric is determined. Finally, problems of metal-insulator-metal technology are discussed, such as various metal vapor sources for vacuum deposition, and the volt-ampere characteristics are measured. Author (ESRO)

N71-23525* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DIGITALLY CONTROLLED FREQUENCY SYNTHESIZER Patent
Rodger A. Cliff, inventor (to NASA) Issued 26 Aug. 1969 (Filed 26 Aug. 1966) 7 p Cl. 328-61; Int. Cl. H03k3/02
(NASA-Case-XGS-02317; US-Patent-3,464,018; US-Patent-Appl-SN-576183) Avail: US Patent Office CSCL 09E

Digitally controlled frequency in pulse frequency modulation (PFM) telemetry systems to produce a number of discrete frequencies which are transmitted serially in accordance with the format of a telemetry data frame. These discrete frequencies are detected at a remote point by a bank of contiguous bandpass filters or a bank of correlators. Official Gazette of the U.S. Patent Office

N71-23530# Purdue Research Foundation, Lafayette, Ind.
CONDUCTION MECHANISMS IN THICK FILM MICROCIRCUITS Semiannual Technical Report, 1 Jul.-31 Dec. 1970
R. W. Vest 1 Feb. 1971 90 p refs
(Grant DAHC15-70-G-0007; ARPA Order 1642)
(AD-718414) Avail: NTIS CSCL 9/5

Previous work on conduction mechanisms in thick film microcircuits is reviewed and the goals of the current project outlined. The design and performance of a programmable time-temperature firing facility, and an automatic resistance measuring system is described. The test system chosen for thick film resistor studies was ruthenium dioxide conductive, PbO-B2O3-SiO2 glass, and 96% Al2O3 substrate. Published data on the thermophysical properties of each of these ingredients are discussed, and results from this project are included to more nearly complete the characterization of each. The contact resistance, of RuO2 powder was measured as a function of isostatic pressure; a change by only a factor of two was observed up to 15,000 psi. Studies of small RuO2 single crystals encased in glass indicated a very low solubility. The resistance of an RuO2 resistor during fabrication was measured, and the results are compared to the behavior of the RuO2 single crystals in glass. Author (GRA)

N71-23531# Maryland Univ., College Park. Dept. of Electrical Engineering.
A SCATTERING MATRIX PROGRAM FOR HIGH FREQUENCY CIRCUIT ANALYSIS
R. W. Newcomb and L. Basser Nov. 1970 6 p refs Prepared in cooperation with Fairchild Camera and Instrument Corp.
(Contract F44620-67-C-0001; Grants AF-AFOSR-1910-70; NSF GK-1956; NSF GK-24036)
(AD-718434; AFOSR-TR-71-0210) Avail: NTIS CSCL 9/5

A time-shared program, SPEEDY, is discussed. The program is for small signal analysis of high frequency active circuits. It is based directly upon 2-port interconnections through the scattering matrix, thus eliminating continuous conversions of parameters of previous routines. Program advantages are speed of calculation, due to the generality of S parameters and the limitation to 2-ports; the convenience of accepting measured S parameter data, and the consequent avoidance of transistor equivalent circuits. The program includes two unique subroutines: one that handles all four possible combinations of parallel and series 2-port interconnections, and one that converts 2-port common emitter transistor parameters to common base or common collector configurations. Author (GRA)

N71-23535# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
ALTITUDE AND TEMPERATURE-ALTITUDE TESTS
15 Jan. 1970 37 p
(AD-718653; MTP-6-2-530) Avail: NTIS CSCL 9/3

The objective of this materiel test procadure is to describe the engineering procedures required to determine the adverse effects of simulated altitude and temperature-altitude environments on the performance and physical characteristics of Communication, Surveillance, and Avionic electronic equipment relative to requirements as expressed in applicable Qualitative Materiel Requirements (QMR), Small Development Requirements (SDR), Technical Characteristics (TC), or other applicable documents. Author (GRA)

N71-23545* National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

SIGNAL RATIO SYSTEM UTILIZING VOLTAGE CONTROLLED OSCILLATORS Patent

Richard F. Broderick, inventor (to NASA) Issued 1 Oct. 1968 (Filed 21 May 1965) 5 p Cl. 307-235
(NASA-Case-XMF-04367; US-Patent-3,404,289; US-Patent-Appl-SN-457874) Avail: US Patent Office CSCL 09E

A signal ratio given system is described wherein two signals whose ratio is to be determined are each fed into a first voltage controlled oscillator and a second voltage controlled oscillator, respectively. The voltage controlled oscillators are used to control the conduction states of a bistable flip-flop circuit. The output signal of the flip-flop circuit is then used to measure the ratio of the two input signals. Official Gazette of the U.S. Patent Office

N71-23546# Central Institute for Industrial Research, Blindern (Norway).

POLARIZATION PHENOMENA AND SODIUM IMPURITIES IN MOS COMPONENTS [POLARISASJONSFENOMENER OG NATRIUM-FORURENSNING I MOS-KOMPONENTER]

Henrik Jakobsen (Ph.D. Thesis – Oslo Univ.) 1969 73 p refs In NORWEGIAN; ENGLISH summary
Avail: NTIS

A study of polarization phenomena in thermal silicon oxide for the purpose of making stable MOS-components is made. Special attention has been paid to pollution of the oxide by sodium which forms mobile ions, and also to how this pollution can be avoided and/or neutralized. Neutron activation analysis was used to detect small amounts of sodium. Stable MOS-transistors were made by the use of phosphorus-doped oxide. Author (ESRO)

N71-23547# Aluminum Lab. Ltd., Banbury (England).

DEVELOPMENT OF SIZE 22 TYPE D.50.S SILICON-MAGNESIUM-ALUMINIUM ALLOY AIRCRAFT CABLES AND TERMINATIONS

G. W. Hunton Aug. 1970 67 p
(Contract KJ-D-3908-CB55C)
(TRC-BR-19785) Avail: NTIS

The performance of size 22 aircraft cables with conductors of type D.50.S silicon-magnesium-aluminum alloy is assessed together with their associated terminations, and these are compared with their copper equivalents. Author (ESRO)

N71-23548* Jet Propulsion Lab., Calif. of Tech., Pasadena.

INDEXING MICROWAVE SWITCH Patent

David L. Nixon and Frank E. McCrea, inventors (to NASA) Issued 31 Dec. 1968 (Filed 27 Dec. 1966) 5 p Cl. 333-98 Sponsored by NASA
(NASA-Case-XNP-06507; US-Patent-3,419,827; US-Patent-Appl-SN-605099) Avail: US Patent Office CSCL 09A

A waveguide switch in which the rotational position of the rotor is controlled by means of a cam follower, extending from the rotor in a direction parallel to its axis of rotation and displaced therefrom is described. The switch includes a cylindrical cam, rotatable about an axis of rotation perpendicular to the axis of rotation of the rotor. The rate of rotation of the rotor is controlled so that the rotor rotates gradually, rather than abruptly, toward each of its fixed positions and remains in such position despite any backlash, caused by suddenly stopping the motor. As a result, proper alignment of the rotor can be maintained over a large number of operational cycles and thereby minimize the maintenance requirements. Also, the smooth, gradual rotation of the rotor minimizes any wear between the stationary and the rotatable waveguide sections of the switch.
Official of the U.S. Patent Office

N71-23549# Sylvania Electronic Systems-East, Needham, Mass.

TRI COLOR CATHODE RAY TUBE Final Technical Report, Jan. 1969 – May 1970

W. Breden Oct. 1970 75 p
(Contract F30602-69-C-0147)
(AD-718423; RADC-TR-70-149-Vol-1) Avail: NTIS CSCL 9/1

A beam penetration color cathode ray tube and associated electronics are analyzed to obtain improved performance in color display systems. Experimental methods are used to optimize the phosphor composition to obtain maximum red display brightness, while maintaining three distinguishable colors. Deflection linearity, color convergence, display brightness and contrast are analyzed to meet the program goals. Designs of an experimental model consisting of a 12-inch diameter CRT, and deflection, focusing, and anode circuitry are outlined. Performance tests and evaluation of the model are described and comparisons with the analysis and program goals are made. It is concluded that, with careful design of deflection and anode circuitry, the beam penetration CRT can be used in high performance color display systems showing color convergence to less than one spot diameter. Author (GRA)

N71-23550# Technische Hogeschool, Delft (Netherlands). Afdeling der Technische Natuurkunde.

DIFFRACTION THEORY OF OPEN RESONATORS

Hans Blok (Ph.D. Thesis) 1970 122 p refs
Avail: NTIS

A diffraction theory of open resonators is developed and the resonant frequencies and field distributions of their resonant modes are computed. Special attention is paid to the Fabry-Perot type resonator with perfectly conducting mirrors, and a ring-shaped resonator consisting of a single reflecting ring. ESRO

N71-23573* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

RADIO FREQUENCY COAXIAL HIGH PASS FILTER Patent

James W. Bailey and Donald F. McAfee, inventors (to NASA) Issued 16 Jul. 1968 (Filed 28 Aug. 1964) 4 p Cl. 333-73
(NASA-Case-XGS-01418; US-Patent-3,393,384; US-Patent-Appl-SN-392969) Avail: US Patent Office CSCL 09A

A high pass filter consisting of two cylindrical capacitors positioned concentrically of one another in a coaxial transmission line is described. The ratio of the inner diameter of the outer capacitor to the outer diameter of the inner capacitor insures impedance matching with the transmission line. In addition, the input and output leads of the inner conductor of the tranmission line are connected to opposite plates of the outer capacitor such that complete dc isolation is obtained.
Official Gazette of the U.S. Patent Office

N71-23598* National Aeronautics and Space administration. Electronics Research Center, Cambridge, Mass.

PARAMETRIC MICROWAVE NOISE GENERATOR Patent

Sungik Francis Paik, inventor (to NASA) Issued 30 Sep. 1969 (Filed 11 Mar. 1968) 3 p Cl. 331-78; Int. Cl. H03b29/00
(NASA-Case-XER-11019; US-Patent-3,470,489; US-Patent-Appl-SN-711971) Avail: US Patent Office CSCL 09E

A radio frequency noise generator having a microwave slow-wave structure immersed in a gas discharge plasma is described. A large-signal microwave traveling through the plasma on the slow-wave structure interacts with nonradiative electrostatic plasma oscillations producing idler waves which are parametrically amplified to produce an output noise signal in the microwave frequency range. Adjustment of the pump signal's amplitude and frequency controls the amplitude and bandwidth of the output noise signal.
Official Gazette of the U.S. Patent Office

N71-23609# Collins Radio Co., Cedar Rapids, Iowa.

INTEGRATED HIGH-FREQUENCY ANTENNA SYSTEM, APPENDIX D Final Report, 13 Nov. 1969 – 9 Nov. 1970

Nov. 1970 361 p refs

(Contract N62269-70-C-0016)
(AD-718054; Rept-523-0763421-00111M-App-D) Avail: NTIS CSCL 9/5

The document describes tests to determine the spectral characteristics of an AN/ARC-132(V) Radio Set consisting of the units and modules specified in paragraph 5.2. The subject tests are a requirement of the Integrated High Frequency Antenna System (IHFAS) Phase III Contract (N62269-70-C-0016), and will be performed in accordance with MIL-STD-449C. Author (GRA)

N71-23610# Princeton-Pennsylvania Accelerator, Princeton, N.J.
ON REGULATION OF MAGNET POWER SUPPLIES OR, WHY USE TRANSISTORS?
25 Nov. 1970 6 p
(Contract AT(30-1)-2137)
(PPAD-677-D) Avail: NTIS

The use of a series transistor bank to improve the ability of a silicon controlled rectifier (SCR) power supply to regulate the current in typical beam transport magnets is discussed. It is concluded that the use of transistor banks from SCR magnet power supplies cannot be justified based on cost, maintenance, and reliability. NSA

N71-23611# Army Electronics Command, Fort Monmouth, N.J.
LOW POWER, SELF-REGULATING THERMISTOR TEMPERATURE CONTROL DEVICE
Bruce F. Semans Dec. 1970 23 p refs
(AD-718614; ECOM-3372) Avail: NTIS CSCL 9/1

A low power, solid state, self-regulating temperature control device has been sought in conjunction with current research being developed in-house for automatic, electronic tuning with non-linear dielectrics. Preliminary experimental results indicated that a positive temperature coefficient, thermistor device can be used in this respect. A solid solution of lanthanum doped barium strontium titanate can be tailored to meet the specifications such as the control temperature desired, the amount of deviation from this temperature as the ambient varies, as well as the maximum allowable power consumption. Results are given that show the feasibility of using a thermistor control device as well as its use in conjunction with a model of a non-linear, voltage variable device currently being developed in-house. Author (GRA)

N71-23612# Owens-Illinois Technical Center, Toledo, Ohio.
THREE-COLOR PLASMA PANEL DISPLAY DEVICE
Quarterly Report, 1 Jul. – 30 Sep. 1970
F. H. Brown, C. W. Salisbury, H. G. Slotton, and M. J. Tamm Dec. 1970 33 p ref
(Contract DAAB07-70-C-0243)
(AD-718268; ECOM-0243-1; QR-1) Avail: NTIS CSCL 9/5

The objectives of this program are to design, fabricate, and evaluate a plasma-panel display device having a three-color capability, and to investigate and develop a technique for operating such a device with at least three levels of intensity. The vacuum-ultraviolet excitation spectra of 10 oxygen-dominated phosphors were measured to assist the selection of those most readily excited by the ultraviolet emission from a Xenon plasma discharge. A phosphor deposition technique involving the use of a thermally tackifiable photo-polymer was extended to the preparation of multi-color panels. An appropriate thermal cycle was established for pyrolysis of the photo-polymer and attachment of phosphor spots to the dielectric surface as dots or donuts. Means for achieving good electrode/phosphor alignment have been identified, and progress has been made in control of registration during panel sealing. The addressability of three intensity levels over large areas of a standard monochrome plasma display panel was demonstrated. Author (GRA)

N71-23615# Naval Postgraduate School, Monterey, Calif.
ACTIVE RC NETWORK SYNTHESIS WITH OPERATIONAL AMPLIFIER
Erol Yuksel (M.S. Thesis) Sep. 1970 175 p refs
(AD-718306) Avail: NTIS CSCL 9/5

Active RC network synthesis techniques with operational amplifiers are reviewed, discussed, and classified according to the number of amplifiers and number of feedback paths in the circuit. After presenting the main properties of active RC network theory, various synthesis techniques are discussed and evaluated according to their merits, by means of sensitivity and stability theory. A modification to Loverings circuit is proposed. Six design examples are presented to illustrate the application of the techniques and to observe the effect of nonideal active and passive components. The designs are practically realized, their performance is tested and experimental results are presented. Reasons for the discrepancies found between theory and experimental results are discussed. Author (GRA)

N71-23664 California Univ., San Diego.
THEORY OF MESH TYPE ANTENNAS IMMERSED IN A WARM ISOTROPIC PLASMA
Maurice Leon Schiff (Ph.D. Thesis) 1969 100 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 70-7935

Impedance and radiation properties of an antenna immersed in a warm isotropic plasma are analyzed. The antenna is assumed to have a three dimensional closely spaced mesh-like structure inside which the electric field vanishes. Grid like (two dimensional) and filamental (one dimensional) structures are special cases of this category. Either the Vlasov or hydrodynamic equations can be used to describe the plasma. Another assumption is that on the surface of the antenna conductor the parallel component of the electric field and the normal component of the fluid velocity vanish. Only the hydrodynamic description has been used in calculations of this second category in which the uniform plasma only occupies the space outside the antenna. Dissert. Abstr.

N71-23886# Cranfield Inst. of Technology (England).
THE DESIGN OF AN ELECTRO-PNEUMATIC SIGNAL CONVERTER
O. Brychta Feb. 1971 18 p ref
(M/P-1) Avail: NTIS

The design of an electro-pneumatic signal converter creating a pneumatic sine wave generator using the back pressure sensing system with ejector is described and the statical and dynamical characteristics are treated. The pneumatic sine wave generator can be used for dynamical testing of fluidic circuits and gates in the frequency range of 15 Hz up to 1000 Hz with the dc level equal to half of the output amplitude, and up to 1500 Hz with higher dc levels. The output amplitude is equal to the supply pressure which has a nominal value in the range of 200 to 400 mm Hg. Author

N71-23887# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AN AUTOMATIC DEVICE FOR INVESTIGATING ANTENNA DOMES
M. A. Vilkotskii et al 16 Nov. 1970 10 p ref Transl. into ENGLISH from Akad. Nauk. Belorussk. SSR (Minsk), v. 14, no. 1, 1970 p 29 – 32
(AD-718288; FTD-TH-23-540-70) Avail: NTIS CSCL 17/9

In the investigation of the influence of a dome on the characteristics and parameters of the antenna covered by it, it is necessary in a number of cases to determine this influence for different positions of the phase center of the antenna under the dome and of the various orientations of the antenna. Such investigations require making from several hundred to several thousands of measurements, i.e., they are very time-consuming. Therefore, it was expedient to completely, or at least partially, automate such measurements. So far as we know, devices intended for such measurements have not been described in the literature. The

automatic device to be described should provide for the automatic motion and orientation of the antenna in question inside the dome, and it should provide for automatic recording of the laws of distribution of the amplitude and phase of the field along the dome surface and a number of other characteristics and parameters of the covered antenna for each position and orientation of the antenna. Author (GRA)

N71-23983*# North Star Research and Development Inst., Minneapolis, Minn.
RESEARCH INTO THE FEASIBILITY OF THIN-METAL AND OXIDE-FILM CAPACITOR Final Technical Report
G. V. Jorgenson and W. H. Graves Mar. 1971 56 p refs
(Contract NAS12-551)
(NASA-CR-72779) Avail: NTIS CSCL 09A

Low energy radio frequency sputtering was utilized in an investigation of the feasibility of producing thin metal- and oxide-film capacitors. The objectives were to establish a useful configuration for a planar film filter capacitor consisting of densely packed parallel interconnected layers with stable electrical properties, and able to withstand high temperature environments. Dielectric material systems examined included silica, alumina, titania, and lead zirconate titanate. Silica gave the best results, even with its lower dielectric constant, because it could be deposited at a higher rate and had more stable characteristics than the other materials. The majority of test capacitors were prepared with silica dielectrics and aluminum electrodes. Many alumina-aluminum capacitors were also tested, but they had lower thermal stability than the silica capacitors. The preferred electrode thickness was established as 1200 to 1500 A, based on measurements of dissipation factor versus electrode thickness. Dielectric strength of the silica films is generally between two- and five-million volts per centimeter. At two-million volts per centimeter, the breakdown strength is 20 volts per 1000 A of dielectric. Based on these measurements, and on the desire to keep thickness down to obtain high capacitance density, dielectrics were normally made 3000 A thick. A capacitor with a working voltage of 25 volts with an adequate safety factor resulted. Author

N71-24025 Lehigh Univ., Bethlehem, Pa.
INTEGRATE CIRCUIT CONTENT ADDRESSABLE MEMORIES
James T. Koo (Ph.D. Thesis) 1969 86 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 70-10807

Feasibility, design, and algorithms of Content Addressable Memory (CAM) Systems employing integrated circuit technology have been investigated. Integrated circuit CAM systems employing single channel insulated gate field effect transistors, complementary insulated gate field effect transistors, and bipolar transistors are studied. The basic memory cell designs consist of a flip-flop as the memory medium and a logic section with a total of six to nine transistors. The logic section consumes little or no standby power and incurs no stage delay during the match operation. The two bit-lines of the cells also serve as input to the logic section, cells can be arranged in a matrix form with four interconnecting signal leads (Word, Match, bit and bit) to form a word organized CAM system. Dissert. Abstr.

N71-24026 Rutgers Univ., New Brunswick, N.J.
A PROCESS FOR THE MANUFACTURE OF THIN FILM CERAMIC CAPACITORS
William Weber Coffeen (Ph.D. Thesis) 1969 116 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 70-10055

The elements of a new practical process were developed to produce thin film ceramic capacitors of titanium dioxide. Dielectric films of anatase ranging in thickness from 0.02 to 0.05 mils in thickness were generated on aluminum foil. The technique involved spraying multiple coats of a slurry consisting essentially of tetraisopropyl titanate in isopropyl alcohol and carrying finely divided titanium dioxide in suspension. Multiple coats were applied to the hot substrate with intermittent firing at temperatures close to 500 C. Air dried silver paint was used for the top electrode. Capacitors produced by this process readily withstood voltages in excess of 25 volts and had insulation resistances of 10 to the 9th power ohms or better. Dissert. Abstr.

N71-24027 Syracuse Univ., N.Y.
TRANSIENT RESPONSE OF WIRE ANTENNAS AND SCATTERERS
Edward Paul Sayre (Ph.D. Thesis) 1969 144 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 70-10391

Direct time domain solutions for radiation from and scattering by thin conducting wires are considered. The problem is formulated in terms of two coupled intergrodifferential equations obtained from the retarded potentials, the continuity equation, and the boundary conditions for the wire. Application of the method of moments reduces these equations to a set of simultaneous matrix equations in terms of currents, charges, and potentials. A time domain reciprocity theorem is developed which demonstrates the relationship between reciprocity and the adjoint operator for the problem. Two moment solutions are presented for straight wires: (1) a point tested solution and (2) a pulse tested solution. Dissert. Abstr.

N71-24028# National Research Council of Canada, Ottawa (Ontario).
THE RESONANT FREQUENCIES OF HUNTING OF ASYNCHRONOUS MOTORS ON NO LOAD: A MACHINE CHARACTERISTIC [DIE PENDELRESONANZFREQUENZ VON ASYNCHRONMOTOREN BEI LEERLAUF: EINE CHARAKTERISTISCHE MASCHINENGROESSE]
H.-W. Lorenzen 1971 18 p refs Transl. into ENGLISH from BBC-Nachr. (Mannheim), v. 50, no. 6, 1968 p 333-339
(NRC-TT-1448) Avail: NTIS

Alternating current asynchronous motors are studied for their specific resonant frequencies of hunting which link electrical and mechanical data (moment of inertia) of such motors in a characteristic manner. Such an index is just as characteristic a machine parameter as the pull out slip, the pull out torque, the no-load current and the ideal short circuit current. Author

N71-24163 National Lending Library for Science and Technology, Boston Spa (England).
CONSTRUCTION AND USE OF INDUCTIVE DECADE VOLTAGE DIVIDERS. PART 2
A. Milles 13 Jan. 1971 33 p refs Transl. into ENGLISH from Metrologia Aplicata (Rumania), v. 17, no. 1, 1970 p 8-17
(NLL-Min-Tech-T-6763-(5809.95)) Avail: Natl. Lending Library, Boston Spa, Engl.: 3 NLL photocopy coupons

The inductive voltage divider is a fundamental device for measuring alternating current ratios. Because of its particularly high precision the inductive divider enables some electrical quantities, the values of which differ from one another by several orders of magnitudes, to be compared directly and their ratios to be determined to 5-7 significant figures with very small errors. Some circuits are considered in which commercial inductive dividers of conventional construction are used. Author

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see 09 Electronic Equipment. For related information see specific Physics categories.

N71-23271* Electro-Optical Systems, Inc., Pasadena, Calif.
POLARITY SENSITIVE CIRCUIT Patent

Lawrence S. Smith, inventor (to NASA) Issued 17 Dec. 1968 (Filed 11 Aug. 1964) 6 p Cl. 317-148.5 Sponsored by NASA (NASA-Case-XNP-00952; US-Patent-3,417,298; US-Patent-Appl-SN-388967) Avail: US Patent Office CSCL 09C

A circuit with one power supply connected to place equal charges on two capacitances connected in parallel is described. The capacitances are connected to have a discharge path in a selected direction through a solenoid coil of a magnetic relay to provide bi-directional movement of the armature. The direction in which a capacitance discharges through the coil is controlled by a first and second switch means. One switch means is closed only by a control signal voltage of positive polarity. The other switch means is closed only by a control signal voltage of negative polarity. With the above construction, any voltage source capable of providing pulses of negative and positive polarity can control the bi-directional movement of the armature.

Official Gazette of the U.S. Patent Office

N71-23315* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

VARIABLE WIDTH PULSE INTEGRATOR Patent

Arthur L. Newcomb, Jr., inventor (to NASA) Issued 3 Jun. 1969 (Filed 15 Mar. 1966) 4 p Cl. 307-234; Int. Cl. H03k5/20 (NASA-Case-XLA-03356; US-Patent-3,448,290; US-Patent-Appl-SN-536216) Avail: US Patent Office CSCL 09C

A solid state device for converting variable width pulses into an analog voltage is described. Two capacitors are alternately charged with a constant current during the durations of said variable width pulses. The two capacitors are discharged during the times that they are not being discharged. The charged capacitors are selectively applied to the output of the device to provide the desired output analog voltage.

Official Gazette of the U.S. Patent Office

N71-23334# Naval Postgraduate School, Monterey, Calif.

EDGE T-MATRIX IN NETWORK THEORY

Le Phung (M.S. Thesis) Sep. 1970 151 p refs (AD-718325) Avail: NTIS CSCL 9/5

Theory of the edge T-matrix is developed and applied to derive algorithms for solving basic problems of network theory such as the determination of a fundamental loop or cut-set matrix, the path matrix, the circuit matrix, the se matrix and the tree summation calculation. Application of the Tree summation to the determination of sensitivity functions without actual derivative operation will also be investigated. Formulas for determining topologically the sensitivity function will be proved.

Author (GRA)

N71-23378# Naval Ordnance Lab., White Oak, Md.

CORRELATION OF QUANTIZED GAUSSIAN PROCESSES

Daniel L. Rumsey 7 Sep. 1970 121 p refs (AD-718803; NOLTR-70-185) Avail: NTIS CSCL 9/4

The well-known Polarity Coincidence Correlator was originally developed to simplify the electronics involved in making an Analog Correlator while roughly approximating its output. The Polarity Coincidence Correlator clips the two input signals about their means and compares the resulting signals for polarity to determine the degree of correlation. No amplitude information is used in this system. The idea of clipping each input signal into two regions, as in the Polarity Coincidence Case, is extended to quantizing each input signal into a greater number of regions. The resulting signals are then compared by region, weighted and summed for the degree of correlation. An expression for the output signal-to-noise ratio for this new type of correlator is developed and compared with the output signal-to-noise ratio of the Analog Correlator (ANC) and the Polarity Coincidence Correlator (PCC). It is shown that a good deal of improvement is achieved over the ANC and PCC under certain operating conditions. The theory behind these new types of correlators is developed for three and four region clipping to show the feasibility of these correlators as possibly better alternatives to the Polarity Coincidence Correlator.

Author (GRA)

N71-23541# Texas Univ., Austin. Electronics Research Center.

RADIATION OF ELECTROMAGNETIC WAVES FROM A FLANGED WAVEGUIDE

George A. Bennett and Oren B. Kesler 15 Oct. 1970 112 p refs (Grant AF-AFOSR-1792-69) (AD-718407; AFOSR-70-2874TR; TR-100) Avail: NTIS CSCL 9/1

The boundary value problem considered in the investigation was that of radiation of electromagnetic waves from a two-dimensional parallel plate infinitely flanged waveguide. It was determined through extensive analysis that Galerkins method is applicable to this problem and that its implementation by partial systems yields excellent results. Specific attention has been given to a study of the accuracy of the method and the results of this study are reported. The method has been utilized to compute results that are not available elsewhere - the first 120 non-zero reflection coefficients for various frequencies in the resonance region. Also for several frequencies in this region, graphs of the reflection coefficient modulus versus mode number, illustrating their asymptotic behavior, are presented. The complete computer program is included for the readers discernment and general reference. Suggestions are made for extensions of this work.

Author (GRA)

N71-23542# Lincoln Lab., Mass. Inst. of Tech., Lexington.

ADVANCED ELECTRONIC TECHNOLOGY Quarterly Technical Summary Report, 1 Aug. – 31 Oct. 1970

Melvin A. Herlin, John F. Hutzenlaub, and Alan L. McWhorter 15 Nov. 1970 27 p (Contract F19628-70-C-0230) (AD-718149; ESD-TR-70-340) Avail: NTIS CSCL 9/2

The Quarterly Technical Summary covers the period from 1 August through 31 October 1970. It consolidates the reports of Division 2 (Data Systems), Division 7 (Engineering), and Division 8 (Solid State) on the Advanced Electronic Technology Program, formerly the General Research Program, at Lincoln Laboratory. The reports under the data systems division on digital computers include: circuit and new machine development, magnetic film engineering, and computer systems; Psychology includes: reckoner/mediator application studies and other work; and computer systems. The engineering division reports on advanced electronic technology including engineering and solid state research. The solid state division reports on advanced electronic technology including reports on solid state device research, materials research, physics of solids, and microelectronics.

Author (GRA)

N71-23543* McDonnell Aircraft Corp., St. Louis, Mo.

POWER SUPPLY CIRCUIT Patent

Donald D. Boedy, inventor (to NASA) Issued 16 Jul. 1968 (Filed 8 Dec. 1964) 4 p Cl. 317-31 Sponsored by NASA (NASA-Case-XMS-00913; US-Patent-3,393,347; US-Patent-Appl-SN-416945) Avail: US Patent Office CSCL 09C

The power supply is designed so that the manufacturer specifications for the series stage transistor are not exceeded. Should a short circuit on the output side of the series stage transistor occur, the transistor will not be destroyed because the decrease in output voltage is utilized to drive the transistor toward cut-off. Furthermore, protection of the regulated power supply output wiring and the unregulated power supply input need not be provided since the maximum current can be predicted.

Official Gazette of the U.S. Patent Office

N71-23544* Westinghouse Electric Corp., Pittsburgh, Pa.

PHASE LOCKED PHASE MODULATOR INCLUDING A VOLTAGE CONTROLLED OSCILLATOR Patent

George R. Vaughan and James B. Sivley, inventors (to NASA) Issued 16 Jul. 1968 (Filed 15 Mar. 1966) 3 p Cl. 332-19 Sponsored by NASA (NASA-Case-XNP-05382; US-Patent-3,393,380; US-Patent-Appl-SN-536217) Avail: US Patent Office CSCL 09C

A system is described wherein a reference frequency is applied to a linear phase detector to which there also applied the divided down output of the phase modulator carrier. Any difference in phase between this divided down phase modulated carrier and the reference frequency is combined with the incoming modulating signal. The result obtained by the addition of these two signals is applied through a low pass filter to a voltage controlled oscillator. The output of the voltage controlled oscillator comprises a carrier having the phase information. This is both transmitted and applied to the frequency divider to be divided down and thereafter applied to the linear phase detector.

Official Gazette of the U.S. Patent Office

N71-23661# Minnesota Univ., Minneapolis. Dept. of Electrical Engineering.

ON THE EQUIVALENCE OF MAXIMUM PRINCIPLE OPEN LOOP CONTROLLERS AND CARATHEODORY FEEDBACK CONTROLLERS FOR TIME DELAY SYSTEMS

Heikki N. Koivo Feb. 1971 19 p refs

(Grant AF-AFOSR-1502-68)

(AD-718437; AFOSR-TR-71-0247) Avail: NTIS CSCL 12/1

The optimal feedback gain matrix derived from the maximum principle for linear time-delay systems with quadratic cost satisfies an integral equation. On the other hand, if the extended Caratheodory lemma is used to solve the same problem, the optimal feedback gains satisfy a set of partial differential equations. It is shown that the resulting feedback gains are equivalent. Author (GRA)

N71-23662* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

APPARATUS FOR PHASE STABILITY DETERMINATION Patent

Grady B. Nichols, inventor (to NASA) Issued 27 Aug. 1968 (Filed 2 Nov. 1964) 4 p Cl. 235-154

(NASA-Case-XGS-01118; US-Patent-3,399,299;

US-Patent-Appl-SN-408442) Avail: US Patent Office CSCL 09C

An apparatus for processing a high frequency signal to be applied to correlation determines its phase stability. Two auxiliary oscillators each provide a signal having the same characteristics as the high frequency signal under consideration, and these are independently multiplied with the high frequency signal to produce two product signals. High frequency components are removed from the product signal to provide two low frequency signals each having a component introduced by the phase instability of the original high frequency signal. These two low frequency signals are digitized and applied to the correlation apparatus whereby the phase and frequency instability of the high frequency signal is determined. Official Gazette of the U.S. Patent Office

N71-23663* National Aeronautics and Space Administration. John F. Kennedy Space center, Cocoa Beach, Fla.

SEPARATION SIMULATOR Patent

Graydon A. Phlieger, Jr., inventor (to NASA) Issued 18 Mar. 1969 (Filed 24 Aug. 1967) 11 p Cl. 200-82; Int. Cl. H01h35/38

(NASA-Case-XKS-04631; US-Patent-3,433,909;

US-Patent-Appl-SN-663180) Avail: US Patent Office CSCL 09C

An apparatus for selectively separating electrical circuits for simulating interstage separation of a flight vehicle is described. The electrical cables from one stage are connected to one set of the simulator's test cables, while those from the next stage are connected to the other set. Each set of cables is attached to connectors in the simulator. Female connectors for one set are mounted on a fixed plate, while male connectors for the other set are mounted on a movable plate. The plates are selectively separated and remated so that functions that occur at stage separation can be simulated during preflight checkout of the space vehicle.

Official Gazette of the U.S. Patent Office

N71-23669* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

FEEDBACK INTEGRATOR WITH GROUNDED CAPACITOR Patent

Gordon J. Deboo, inventor (to NASA) Issued 30 Sep. 1969 (Filed 28 Dec. 1967) 4 p Cl. 331-111; Int. Cl. H03k3/26

(NASA-Case-XAC-10607; US-Patent-3,470,495;

US-Patent-Appl-SN-694345 Avail: US Patent Office CSCL 09C

A feedback integrator employs a capacitor having one terminal grounded and the other terminal connected to one input of an operational amplifier. Input signals are applied through equal resistors to the amplifier input terminals, and the circuit operates to integrate the difference between the input signals. The polarity of the output may be controlled by appropriate connection of the inputs. Switching elements may be connected across the capacitor to produce either a free running or a controlled sweep generator. This control may also be used to reset the capacitor to an initial value when a variable input signal is being integrated.

Official Gazette of the U.S. Patent Office

N71-23715*# North American Rockwell Corp., Anaheim, Calif.

PROCESS TECHNIQUES STUDY OF INTEGRATED CIRCUITS Final Scientific Report

Jerry V. Brandewie and C. W. Scott Jun. 1970 241 p refs

(Contract NAS 12-4)

(NASA-CR-117904) Avail: NTIS CSCL 09C

The determination of why structural defects are produced in thermally grown oxides and the definition of corrective actions for their elimination are considered. A dielectric defect detection tool was developed for locating defects in oxides and to isolate potential process and structural parameters which effect defect densities. Results confirmed that a significant cause of oxide defects was the thermal expansion mismatch between silicon and silicon oxide. An improved surface preparation technique was developed which significantly reduced defect densities. Also reported are gas ambient studies in which the effects of hydrogen and water on the performance of various transistor samples were evaluated. A group of integrated circuits was exposed to various ambient conditions. Other studies performed provided insight into the origin of atomic species contributing to inversion. A compilation of failure analysis techniques and package hermeticity test methods are included.

Author

N71-23873# Arizona Univ., Tucson.

NONLINEAR LEAD COMPENSATOR

W. P. Jenney *In its* Publ. of the Computer Sci. Res. Lab., 1969 1970 1970 p 71 73 refs (See N71-23862 12-08)

Avail: NTIS

Waveforms are analyzed and a simple design for system mechanization presented. The performance of the Split Path Nonlinear compensator in a third order control system is discussed and compared with a lead-lag network and the optimal linear controller. Author

N71-24029 Syracuse Univ., N.Y.

STABILITY OF A CLASS OF DISTRIBUTED RC NETWORKS WITH NONLINEAR ELEMENTS

Guillermo Prada (Ph.D. Thesis) 1969 101 p

Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 70-10381

The stability of electrical networks consisting of the interconnection of linear lumped parameter elements and memoryless nonlinear elements with uniformly distributed RC lines is studied. It is shown that a large class of such networks can be represented by a functional-differential equation of the retarded type. A function is defined and used to derive a set of theorems and corollaries concerning the stability and instability of the network. To illustrate the results, some examples are given.

Dissert. Abstr.

N71-24030 Utah State Univ., Logan.
MOMENT SOLUTION OF CYLINDRICAL ANTENNA CURRENT AND IMPEDANCE IN WARM, ISOTROPIC PLASMAS
Douglas Henry Preis (Ph.D. Thesis) 1970 124 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 70-10924

A numerical technique is developed to compute the impedance and current distribution of a cylindrical antenna immersed in a warm, isotropic, collisional electron plasma. The antenna is approximated by a finite number of cylindrical shells having arbitrary size but a common axis. Assuming a collapsed ion sheath, the potential, electron density, and electron flux are interrelated by Poisson-s equation and two-stream distribution function moments of Boltzmann's equation. The system of differential equations is solved in cylindrical geometry subject to the absorptive boundary condition. The method of moments (point matching and step approximation) is used to develop a matrix network equation which relates cell voltages to cell currents via a derived impedance matrix. Dissert. Abstr.

N71-24031 Rensselaer Polytechnic Inst., Troy, N.Y.
OUTPUT FEEDBACK CONTROL WITH APPLICATION TO UNSTABLE LINEAR SYSTEMS
William David Koenigsberg (Ph.D. Thesis) 1969 123 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 70-11323

The control of a linear, time invariant, dynamic system is considered by use of output feedback control, in order that its response be improved, or, for that matter, stabilized. This corresponds to manipulating the closed loop eigenvalues of the system in such a way that they assume desired positions in the complex plane. For an unstable system, the problem is to determine a set of feedback gains which will cause the system to be stable. A new method is presented, which, for all practical purposes, provides a way to solve this problem. The method, which has been implemented on a digital computer, is iterative in nature, involves the use of eigenvalue sensitivities, and is applicable to stable or unstable systems. Dissert. Abstr.

N71-24032 Texas A&M Univ., College Station.
THE MUTUAL IMPEDANCE BETWEEN COUPLED ELECTRICALLY THICK FOLDED DIPOLES
Jung Uck Seo (Ph.D. Thesis) 1969 92 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 70-9718

An analytical expression for the mutual impedance between two identical, electrically thick coupled folded dipoles in nonstaggered parallel orientation has been developed. A boundary value problem was solved to formulate an integral equation for the current distributions on two mutually coupled single conductor cylindrical dipoles. The coupled folded dipoles configuration was then found from the single conductor case. The mutual impedance was found from the symmetric and antisymmetric components of antenna current using the superposition theorem. Dissert. Abstr.

N71-24033 Syracuse Univ., N.Y.
FUNCTIONAL ANALYSIS OF PHASED LOCKED LOOPS
George R. Fath (Ph.D. Thesis) 1969 185 p
Avail: Univ. Microfilms: HC $8.40/Microfilm $3.00 Order No. 70-10339

The response of a phase locked loop to a fixed frequency offset is analyzed. The Volterra functional expansion is used to derive a new approximation to the transient behavior of the loop and to derive an approximation to the RMS noise phase error when the loop is corrupted by white Gaussian noise. The loop pull-in range is also approximated by describing a separatrix as a projection onto a subspace of a Banach space. Sufficient comparisons are provided to permit verifying the results derived with experimental data with confidence. The same techniques are then applied to the relatively new phase locked loop frequency demodulator. Results are compared with simulation data and good agreement is shown. Dissert. Abstr.

N71-24133 National Lending Library for Science and Technology, Boston Spa (England).
ELECTRONIC BRAIN IN PRODUCTION. ON THE WORK OF LATVIAN CYBERNETICISTS
E. Yakubaitis 16 Feb. 1971 6 p Transl. into ENGLISH from Sov. Latvia, (Latvia), 18 Jan. 1971 p 1–5
(NLL-M-20340-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Developments in the field of engineering cybernetics are described. The work of Latvian cyberneticists and their role in furthering scientific and technical progress in the Latvian economy are presented. Author

N71-24148 Michigan State Univ., East Lansing.
ASYMPTOTIC CONVERGENCE OF NONLINEAR, CONTINUOUS TIME FILTERS
Michael Wesley Bird (Ph.D. Thesis) 1969 109 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 70-9496

Modern nonlinear, continuous time filtering theory, characterized by the use of state variable technqiues, is potentially applicable to many real world problems. One aspect of nonlinear filter performance which has received no attention is asymptotic behavior. Suggested is a method for demonstrating the asymptotic performance of a class of continuous time, nonlinear filters in the scalar case. The time domain filtering problem consists of a message process, represented as the solution to a first order differential equation with unknown initial condition, and an observation process, modeled as a signal containing the message to which white noise is added. Filters considered are sequential, being represented by first order differential equations which are identical to the model of the message process plus a correction term. Dissert. Abstr.

N71-24149 Texas Univ., Austin.
FEEDBACK DECOUPLING OF TIME DELAY DIFFERENTIAL EQUATIONS
Halbert Homer Bybee, Jr. (Ph.D. Thesis) 1969 59 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 70-10764

Sufficient conditions are derived for the decoupling of certain time delay system with m inputs and m outputs into m, independent, single input, single output systems. The systems considered are described by linear, time invariant, ordinary, time delay, differential equations in normal state variable form with one constant delay length. A class of state variable feedback is generated to accomplish the decoupling. Dissert. Abstr.

N71-24150 Syracuse Univ., N.Y.
THERMAL CONTACT CONDUCTANCE DUE TO PLANE LAYERS OF ADSORBED GASES AT THE INTERFACE OF SMOOTH METALLIC CONTACTS
Satish K. Wadhwa (Ph.D. Thesis) 1969 82 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 70-10401

The role played by the oxide and the ever present adsorbed gases at the interface of two metals on contact conductance in the absence of electron flow is investigated. The parent metal, the oxide and the adsorbed gases are considered as discrete lattice of a harmonic spring mass system. In the one dimensional model, nearest neighbor interaction is assumed; in the three dimensional model of a cubic lattice with nearest neighbor, central and angular

force constants, planar discontinuities are assumed both in coupling forces and the mass of the atoms. Net transmission of energy is calculated by considering the reflection of plane harmonic waves of the various discontinuities. The results indicate that in the absence of electron flow, even very thin film of adsorbed gases has a very deleterious effect on the conductance across smooth surfaces. Dissert. Abstr.

N71-24151 Cornell Univ., Ithaca, N.Y.
OPTIMAL CONTROL OF PARAMETRICALLY DISTURBED LINEAR SYSTEMS
Gerald John Michael (Ph.D. Thesis) 1969 36 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 70-6010

A problem of large plant parameter variations in linear optimal control systems is formulated and solved. A general method is presented for the synthesis of a linear time invariant feedback controller which produces asymptotic stability of the closed loop system for a given class of large plant parameter variations. The optimal controller represents linear, time invariant, state variable feedback. Liapunov theory is used to determine a class of disturbances for which the closed loop disturbed system is asymptotically stable. Dissert. Abstr.

N71-24216# Academy of Sciences (USSR), Moscow.
CYBERNETICS AND THE SPONTANEOUS MOVEMENT OR ACTIVITY OF MATTER (CONCEPTS OF UNIVERSE, THE WORLD, OR ALL OF NATURE)
L. A. Petrushenko 1971 292 p refs In RUSSIAN
Avail: NTIS

Using subject matter from engineering physiology, and biology, the relationship is analyzed between systems spontaneous movement or activity, their movement upward (self-organization) and downward (disorganization), and the laws of the growth of entropy and self-regulation. A system is described in terms of its components and the concepts of formation, multiplicity, organization, information, and control. One of the limiting conditions for the existence of a system is analyzed as an application of the concept of the world in general. It is concluded that the world is a perpetual, spontaneously moving, non-developing system to which the concept of progression and regression is inapplicable. Spontaneous motion of the world as a system is realized on the basis of two fundamental dialectally interrelated forms: self-organization and self-disorganization. The possibility is substantiated of applying a generalized indication of entropy growth to the study of world self-disorganization, and autoregulation to the study of self-organization. Transl. by E.C.

N71-24219# Academy of Sciences (USSR), Moscow. Section on Philosophical Problems of Cybernetics.
HEURISTIC PRINCIPLES AND LOGICAL COMPUTATIONS
O. F. Serebryannikov 1970 284 p refs In RUSSIAN
Avail: NTIS

Questions are examined on the expression of heuristic principles in precise logic computation terms and the application of these computations in the construction of formal heuristic activity models to solve a broad range of either scientific or pedagogical problems. Also considered is the role of nontriviality in the expression of logic calculation terms. Transl. by E.C.

N71-24222# Academy of Sciences (USSR), Moscow. Scientific Council on the Complex Problem of Cybernetics.
PROGRAMMED INSTRUCTION AND CONCEPTIONS OF CYBERNETICS: ANALYSIS OF FOREIGN TECHNOLOGY
N. D. Nikandrov 1970 207 p refs In RUSSIAN
Avail: NTIS

A literature survey is presented on the status of programmed instruction in England, France, West Germany, and the U.S. Theoretical problems are assessed on programmed instruction systems, methods for formulating programmed materials, and practical applications. Potential applications in the Soviet educational system are highlighted. Transl. by E.C.

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N71-23122*# Massachusetts Inst. of Tech., Cambridge. Aerophysics Lab.
DATA REDUCTION TECHNIQUES FOR USE WITH A WIND TUNNEL MAGNETIC SUSPENSION AND BALANCE SYSTEM Interim Technical Report, Nov. 1968 - Jun. 1970
George D. Gilliam Jun. 1970 70 p refs
(Contract NAS1-8658)
(NASA-CR-111844; TR-167) Avail: NTIS CSCL 14B

The equations relating the forces and moments exerted on a body by the magnetic fields produced by the MIT NASA prototype magnetic balance are presented. A computer program which will derive the aerodynamic coefficients for a body using these relations is listed along with a sample output. A preliminary procedure for aligning the axis of the magnetic suspension system with a reference axis is detailed. A procedure for determining dynamic-stability derivatives is outlined. Author

N71-23123# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
CALIBRATION AND TEST SERVICES OF THE NATIONAL BUREAU OF STANDARDS
Dec. 1970 176 p refs
(NBS-SP-250) Avail: SOD $2.00 CSCL 14B

A descriptive listing, item by item, of most of the test and calibration work done at the National Bureau of Standards with the respective fees is presented. The content is fully indexed providing easy access to data on specific measurement services. Also included is information about the Bureau's organization and statutory functions, the procedures for requesting tests, and the reports issued. Throughout the text are mentioned various other publications which form a bibliography in measurement techniques. Author

N71-23129# National Accelerator Lab., Batavia, Ill.
SAFETY REPORT: 15-FOOT BUBBLE CHAMBER
Nov. 1970 147 p refs Sponsored by AEC
(NAL-48-2624) Avail: NTIS

The NAL 15-foot hydrogen bubble chamber is determined safe for operation. The hazards associated with the facility have been considered and provisions were incorporated into the design to insure a minimum risk to equipment and operators. The material necessary for the final design of the buildings and facilities was studied, and descriptions of all the equipment which plays an important role in the layout and arrangements of the area are given. A detailed stress analysis on the 22-foot diameter vacuum tank, a failure mode analysis of a large rupture of the bubble chamber with spillage of liquid into the vacuum vessel, and a cryogenic systems safety report are presented. NSA

N71-23168# Oak Ridge National Lab., Tenn.
[REACTOR INSTRUMENTATION AND CONTROL AND RADIATION MONITORS] Annual Progress Report, Period Ending 1 Sep. 1970

G. S. Sadowski, comp. Nov. 1970 169 p refs
(Contract W-7405-eng-26)
(ORNL-4620) Avail: NTIS

Reactor component and instrument systems engineering and development projects are summarized. Liquid metal fast breeder and high-flux isotope reactor, in-pile loop, and linear and Van de Graaff accelerator instrumentation are covered including reactor control systems, electronics, ionizing particle and radiation detectors, radiation monitoring systems, safety devices, thermocouples, automatic control, data collectors, ecological study devices, and maintenance equipment. J.M.

N71-23183# Princeton-Pennsylvania Accelerator, Princeton, N.J.
NASA. BRIEFING ON HIGH ENERGY, HEAVY ION CAPABILITIES OF THE PRINCETON-PENNSYLVANIA ACCELERATOR
M. G. White 8 Oct. 1970 20 p
(Contract AT(30-1)-2137)
(PPAD-676-E) Avail: NTIS

The energy distribution and relative abundance of high-energy heavy ions in cosmic rays are discussed, and hazards of heavy cosmic particles to man and equipment are briefly considered. The capabilities of the Princeton–Pennsylvania accelerator for acceleration of heavy ions are described. A proposal for a ceramic vacuum chamber for the accelerator is outlined, and expected parameters for heavy-ion acceleration are tabulated. NSA

N71-23186*# Massachusetts Inst. of Tech., Cambridge. Measurement Systems Lab.
AN AIRSPACE UTILIZATION MODEL FOR V/STOL TERMINAL OPERATIONS
Dorian Albert De Maio (M.S. Thesis) Jan. 1971 95 p refs
(Contract NAS12-2081; Grant NGR-22-009-010; Contract DOT-TSC-5)
(NASA-CR-117887; TE-45) Avail: NTIS CSCL 01E

The computer processes inputs describing the terminal area and accompanying constraints and displays on a cathode ray tube the airspace utilization model, a three dimensional image representation of the constraints at a given altitude. Extensive machine/operator interaction is provided to select various constraint criteria, to plan approaches and departures and to check the results through viewing and teletype output. The program is general and may be applied to a number of terminal areas. The programs' applicability and usefulness is demonstrated in the analyses of several proposed V/STOL port sites in the Northeast Corridor. Approach and departure paths are developed for each site and observations are made regarding flight path characteristics. The computer display leads to drastic reductions in time and effort over a comparable manual task in terminal area studies. Author

N71-23201*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE DEEP SPACE NETWORK, VOLUME 2 Progress Report, Jan. – Feb. 1971
15 Apr. 1971 189 p refs
(Contract NAS7-100)
(NASA-CR-117893; JPL-TR-32-1526-Vol-2) Avail: NTIS CSCL 14B

CONTENTS:

1. DESCRIPTION OF THE DSN p 1–5 refs (See N71-23202 12-11)
2. MISSION SUPPORT p 6–41 refs (See N71-23203 12-30)
3. ADVANCED ENGINEERING p 42–121 refs (See N71-23204 12-29)
4. DEVELOPMENT AND IMPLEMENTATION p 122–144 refs (See N71-23205 12-11)
5. OPERATIONS AND FACILITIES p 145–181 refs (See N71-23206 12-08)

N71-23202*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DESCRIPTION OF THE DSN
In its The Deep Space Network, Vol. 2 15 Apr. 1971 p 1–5 ref (See N71-23201 12-11)
Avail: NTIS CSCL 14B

The objectives, functions, and organization of the Deep Space Network are summarized. The Deep Space Instrumentation Facility, the Ground Communications Facility, and the Space Flight Operations Facility are described, along with the new operatios control system for high speed transfer of operational control information. A.L.

N71-23205*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DEVELOPMENT AND IMPLEMENTATION
In its The Deep Space Network, Vol. 2 15 Apr. 1971 p 122–144 refs (See N71-23201 12-11)
Avail: NTIS CSCL 14B

Deep Space Network (DSN) development and implementation progress is reported for: (1) Space Flight Operations Facility (SFOF) cable control; (2) pre-mission Central Processing System/SFOF checkout procedures; (3) Ground Communications Facility reconfiguration of Goldstone DSCC microwave terminals for 50-kbit data transmission; (4) coherent reference generator for DSN Mark 3A Data System; (5) tracking and data system near-earth telemetry automatic switching unit; (6) DSN discrepancy reporting subsystem; and (7) optimal frame synchronization. A.L.

N71-23342# Naval Aerospace Medical Inst., Pensacola, Fla.
DESCRIPTIVE CATALOG OF AEROSPACE MEDICAL BIODYNAMICS FACILITIES IN THE UNITED STATES AND CANADA
Charles F. Gell, ed. *In* AGARD Principles of Biodynamics Applicable to Manned Aerospace Flight Prolonged Linear and Radial Acceleration Mar. 1971 p 57–100 (See N71-23337 12-05)
Avail: NTIS

A descriptive text and pictorial display are presented of the newest equipment and latest modifications of older equipment used in biodynamic studies conducted in United States Government facilities and in Canadian facilities. Facilities and equipment discussed are located at: (1) Naval Aerospace Medical Institute; (2) Aerospace Medical Research Department; (3) Aerospace Crew Equipment Laboratory; (4) 6570th Aerospace Medical Research Laboratories; (5) 6571st Aeromedical Research Laboratory; (6) United States Air Force School of Aerospace Medicine; (7) Manned Spacecraft Center; (8) Ames Research Center; (9) Civil Aeromedical Institute; (10) National Aviation Facilities Experimental Center; (11) Section of Physiology, Mayo Foundation and Mayo Clinic; and (12) Defense Research Establishment Toronto, Canada. A.L.

N71-23343# Military School of Aviation Medicine, Rome (Italy).
BIODYNAMICS FACILITIES IN NATO EUROPEAN COUNTRIES
Aristide Scano, ed. *In* AGARD Principles of Biodynamics Applicable to Manned Aerospace Flight Prolonged Linear and Radial Acceleration Mar. 1971 p 101–124 refs (See N71-23337 12-05)
Avail: NTIS

Photographs and descriptive texts are presented of facilities and equipment for biodynamic studies and research in France, Italy, and England. A.L.

N71-23480# Ballistic Research Labs., Aberdeen Proving Ground, Md.
WIND TUNNEL SUPPLY HEADERS
Anders S. Platou Dec. 1970 45 p refs
(AD-718227; BRL-MR-2085) Avail: NTIS CSCL 14/2

It has been found that good quality, low turbulence flow in a wind tunnel test section is dependent on the flow and

turbulence conditions in the supply header. This report indicates how good quality, low turbulence flow can be obtained in a supply header and presents flow surveys taken in a supply header before and after modification. Author (GRA)

N71-23580# Stanford Linear Accelerator Center, Calif.
TWO MILE ACCELERATOR PROJECT Quarterly Status Report, 1 Jul. – 30 Sep. 1970
Dec. 1970 90 p refs
(Contracts AT(04-3)-400; AT(04-3)-515)
(SLAC-128) Avail: NTIS

A status report on the Stanford Linear Accelerator Project covering the period July 1, 1970 to September 30, 1970 is presented. Topics included are accelerator and research area operations, accelerator and research area equipment development, and physics research equipment development. Author (NSA)

N71-23581# Army Research Office, Durham, N.C.
NUMERICAL ANALOG FOR A MODEL VACUUM-AIR TRANSPORT SYSTEM Interim Technical Report
Joseph C. Cudlin, Charles M. Harman, and James J. Murray Jan. 1970 55 p refs
(AD-718763; AROD-S-7.10-E; ITR-10) Avail: NTIS CSCL 13/6

An experimental facility is being operated which is capable of hydrodynamically simulating a full-scale pneumatic tube transportation system. This system includes a tube of 1800 foot length and 1 foot diameter, an instrumented vehicle, and a compressor capable of propelling the vehicle at high speed. A mathematical model is presented which also simulates the tube system. This model uses numerical techniques to provide a comparison between analytical results and the limited experimental results. The operating characteristics of a prototype system are presented using these analytical results. Author (GRA)

N71-23600# Explosives Research and Development Establishment, Waltham Abbey (England).
PRECIPITATION UNIT FOR INITIATORS (600 ml GROSS CAPACITY VESSEL)
A. K. Clarke, J. M. Jenkins, and J. G. Rankine Feb. 1970 15 p
(ERDE-TN-19) Avail: NTIS

A simple small scale laboratory unit is described for reproducing precipitations of hazardous materials under standard conditions of temperature, blade form, speed, etc. The operation being carried out in an armored fume cabinet, speed of rotation, temperature, capability of pouring mother liquor, wash water, and finally decanting the precipitate into individual receptacles is controlled from the outside. Author (ESRO)

N71-23633# Radio Corp. of America, Moorestown, N.J. Defense Electronic Products.
MEASUREMENT COMPARISON PROGRAMS
Herbert S. Ingraham, Jr. *In* NBS Innovative Metrology: Key to Progr. Mar. 1971 p 39–40 (See N71-23626 12-14)
Avail: SOD $1.50

The measurement comparison program of 1965 circulated unknowns in pairs, allowing use of Youden diagrams to distinguish systematic from random error. In 1969, two pairs were sent out several months apart, allowing check of the correlation effect; a round robin was started on acceleration; a 24-inch end standard was included in the physical package. Author

N71-23651*# National Aeronautics and Space Administration.
A SWEEP GAS FACILITY FOR FISSION GAS RELEASE STUDIES AT THE NASA PLUM BROOK REACTOR
Thomas A. Kirchgessner, Michael B. Weinstein, and Thomas N. Tambling Washington May 1971 20 p
(NASA-TM-X-2267) Avail: NTIS CSCL 14B

A sweep gas facility for measuring fission gas release rates from power producing fuel specimens was constructed. The helium sweep gas flow system and its supporting equipment are described. A scintillation detector system was used for online fission gas isotope analysis. Samples of the sweep gas were easily obtained for detailed laboratory analysis. The sweep gas facility operated satisfactorily in tests with mockup and actual fuel samples up to a current operating limit of 300 watts fission heat generation rate. Author

N71-23727# Los Alamos Scientific Lab., N.Mex.
THE MEDIUM ENERGY PHYSICS PROGRAM Quarterly Status Report, Period Ending 31 Oct. 1970
Dec. 1970 54 p refs
(Contract W-7405-eng-36)
(LA-4571) Avail: NTIS

The status of accelerator structures, rf power systems, accelerator control and instrumentation, and the experimental area is outlined. Also, accelerator physics research, LAMPF scheduling and facility construction, and the LAMPF users group are discussed. NSA

N71-23906*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HYPERVELOCITY PARTICLE ACCELERATOR EVALUATION
R. S. Marriott and T. P. Sciacca, Jr. Washington May 1971 21 p refs
(NASA-TN-D-7017; G-997) Avail: NTIS CSCL 14B

An evaluation is presented of a hypervelocity impact facility claiming a projectile velocity of 20 to 25 km/s. Solar-cell test panels, subjected to bombardment in the accelerator chamber to determine the change in power output after exposure to hypervelocity impacts and cryogenic conditions, were selected for the experiment. The experimental procedure and results are described. Author

N71-23948 Cornell Univ., Ithaca, N.Y.
OPERATIONAL CHARACTERISTICS AND ENTRANCE CONDITIONS OF A HIGH CURRENT RELATIVISTIC ELECTRON BEAM ACCELERATOR
John Joseph Clark (Ph.D. Thesis) 1969 146 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 70-5762

The design and construction of a 500 KV, 100 KA, 50 nsec pulse duration, electron beam accelerator used as a basic plasma-physics research tool are discussed. The operational characteristics of a high-field-emission diode which is used to launch the electron beam in such an accelerator system are discussed in detail. The diode is shown empirically to have two separate and distinct modes of operation which depend on the diode aspect ratio, pressure, and total diode voltage and current. The electrons which form the beam are emitted from a metal-dielectric plasma cathode. The dielectric sections of this plasma cathode are shown to make an important contribution to the spatial uniformity of cathode emission by means of a surface multipactor or surface flashover effect which vaporizes enough of the dielectric to allow a plasma sheath to form in front of the cathode. Dissert. Abstr.

N71-24128*# Boeing Co., Wichita, Kans.
DESIGN OF A SIMULATED CRUISE SCENE VISUAL ATTACHMENT. VOLUME 1: DESIGN REPORT
Robert J. Rue and Chester W. Kielar Dec. 1970 85 p refs
(Contract NAS2-5524)
(NASA-CR-114301; D3-8484-1-Vol-1) Avail: NTIS CSCL 14B

The design and specification of a television-type out-the-window visual simulation image generator for manned flight simulation of aircraft or spacecraft are presented. A literature search was conducted and a list of publications is included. Several design approaches were developed and a comparison matrix was

established to systematically evaluate these approaches. A specific approach was selected and a final design was completed and analyzed. The design includes the generation of a multi-window image and presents a high altitude scene only giving angular motion cues. Author

N71-24127*# Boeing Co., Wichita, Kans.
DESIGN OF A SIMULATED CRUISE SCENE VISUAL ATTACHMENT. VOLUME 2: MAJOR AND CRITICAL COMPONENT SPECIFICATIONS
Dec. 1970 30 p
(Contract NAS2-5524)
(NASA-CR-114302; D3-8464-2-Vol-2) Avail: NTIS CSCL 14B

The specifications of major and/or critical components are outlined which were selected to construct a simulator cruise scene visual attachment for manned aircraft or spacecraft flight simulation. The hardware used to assemble the system is compatible with the components listed with parameters critical to the performance of the system. Author

N71-24128*# Boeing Co., Wichita, Kans.
DESIGN OF A SIMULATED CRUISE SCENE VISUAL ATTACHMENT. VOLUME 3: ASSEMBLY AND DETAIL DRAWINGS
Dec. 1970 27 p
(Contract NAS2-5524)
(NASA-CR-114303; D3-8464-3-Vol-3) Avail: NTIS CSCL 14B

The assembly and detail design drawings for a cruise scene visual attachment system are presented for a manned spacecraft or aircraft flight simulator. The device will provide television video for a maximum of five out-the-window displays depicting a high altitude, cruise condition. Author

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N71-23102*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYSIS OF ROTATIONAL EFFECTS ON COMPRESSIBLE VISCOUS FLOW ACROSS SHAFT FACE SEALS
John Zuk and Lawrence P. Ludwig [1971] 32 p refs Presented at the Ann. Meeting of the Am. Soc. of Lubrication Engr., Boston, 3 - 6 May 1971
(NASA-TN-X-52991) Avail: NTIS CSCL 20D

The flow across a parallel sealing dam of the type that appears in noncontacting shaft face seals is analyzed for steady, laminar, subsonic, isothermal compressible flow with relative rotation of the sealing dam surfaces. Rotational effects on leakage rates, pressure profiles, and other physical quantities of interest are found. Conditions are given under which a hydrostatic analysis of the radial leakage flow is a valid approximation. The error in estimating the mass leakage by using the hydrostatic radial flow formula is given. Engineering formulas presented include mass leakage flow rate, pressure and velocity distributions, opening force and center of pressure. The physics of the flow are discussed. Author

N71-23103*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL INVESTIGATION OF AN AXISYMMETRIC FULLY DEVELOPED LAMINAR FREE JET
Eugene P. Symons and Thomas L. Labus Washington Apr. 1971 19 p refs
(NASA-TN-D-6304; E-6052) Avail: NTIS CSCL 20D

An experimental investigation was conducted to determine dynamic characteristics of a circular, fully developed, laminar free jet. Complete velocity profiles are presented at Reynolds numbers of 437 and 1839 at 0, 3, 6, 10, 15, and 25 diameters from the nozzle exit. Centerline velocity decay was obtained over a range of Reynolds numbers from 255 to 1839. Also presented are the angles of spread associated with the diffusion of the jet downstream of the nozzle. Where possible, results are compared with those obtained for laminar jets having an initially flat or uniform velocity profile at the nozzle exit. Author

N71-23121# Rutgers Univ., New Brunswick, N.J. Dept. of Mechanical and Aerospace Engineering.
PHYSICAL AND NUMERICAL EXPERIMENTS ON TIME-DEPENDENT ROTATIONAL COUETTE FLOW
David C. S. Liu and C. F. Chen Feb. 1971 147 p refs
(Grants NSF GK-2096; NSF GK-14275)
(RU-TR-136-MAE-F) Avail: Issuing Activity

Physical experiments were carried out in an annular region formed by two concentric cylinders. A dye injection technique was used to make the motion of the fluid visible. The range of Reynolds number investigated varied from 38 to 596. Both the onset time of the secondary flow and the average spacing between the disks were measured from the motion picture films, and comparisons were made with existing data. In the numerical experiments, explicit finite-difference approximations were used to solve the nonlinear partial differential equations. Calculations were made for an infinte geometry and the results were compared with experimental data. The onset time of the secondary flow obtained both by examining the development of streamlines and the kinetic energy of the perturbations compared favorably with the experimental observations. Author

N71-23192# Joint Publications Research Service, Washington, D.C.
ANALYSIS OF FLOW AROUND LIVING SPINY DOGFISH (SQUALUS ACANTHIAS) USING AN INFORMATION SYSTEM
Yu. N. Varich 22 Apr. 1971 6 p refs Transl. into ENGLISH from Zool. Zh. (Moscow), v. 50, no. 1, Jan. 1971 p 126 - 129
(JPRS-52938) Avail: NTIS

Flow characteristics around living spiny dogfish in the range of Reynolds numbers from 40,000 to 500,000 are analyzed. It was established that low-frequency turbulent pulsations were absent from the boundary layers of the fish studied. The data was obtained using specially designed sensors attached to various parts of the fish's body. Author

N71-23193# Lockheed Missiles and Space Co., Palo Alto, Calif.
ASYMPTOTIC SOLUTION OF THE PROBLEM OF OSCILLATIONS OF A SOLID PROFILE IN TRANSONIC GAS FLOW
G. F. Sigalov 1971 5 p refs Transl. into ENGLISH from Dopovidi Akad. Nauk Ukr. RSR. (Kiev), no. 1, 1971 p 80 - 84
Avail: NTIS; National Translations Center, John Crerar Library, Chciago, Ill. 60616

An asymptotic method of investigating nonlinear problems is developed on whose basis the problem of the oscillation of a solid profile in a transonic shockless adiabatic inviscid gas flow is investigated at Mach numbers somewhat less than the critical. Complete approximation is based on reflection of the physical space into a new auxiliary space, the space of the approximations, and is realized by means of a special deformation of the coordinates which converts the nonlinear differential equation in the physical

space into a linear equation in the space of the approximations. The boundary value problem for a nonlinear differential equation which described the low-frequency oscillations of a solid profile in a transonic gas flow is given. Author

N71-23223# Naval Ordnance Lab., White Oak, Md.
THE VERTICAL WATER ENTRY OF A CONE 2
Charles F. Weber 16 Sep. 1970 32 p refs
(AD-718809; NOLTR-70-167) Avail: NTIS CSCL 20/4

The report discusses improvements in a method of solving the water entry problem discussed in N69-32599, and presents the most recent results. Author (GRA)

N71-23312*# Scientific Translation Service, Santa Barbara, Calif.
PROPAGATION OF DISTURBANCES ABOVE THE FLOW DURING THE INTERACTION OF A HYPERSONIC FLOW WITH A BOUNDARY LAYER [RASPOSTRANENIYE VOZUMSHCHENIY VVERKH PO TECHENIYU PRI VZAIMODEYSTVII GIPERZVUKOGO POTOKA S POGRANICHNYM SLOYEM]
V. Ya. Neyland Washington NASA Apr. 1971 18 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza (Moscow), no. 4, Jul.–Aug. 1970 p 40–49
(Contract NASw-2035)
(NASA-TT-F-13522) Avail: NTIS CSCL 20D

It is shown that for a hypersonic flow with moderate or strong interaction, disturbances created, for instance, by a base section or some obstacle are propagated to the front edge of the body. No local areas with very large pressure gradients can be formed in the flow. It is then possible for zones of separation to form, having a length on the order of the body size and described, to the first approximation by boundary layer equations. From a mathematical point of view, the problem reduces to establishing the nonsingularity of the solution near the front edge, and finding proper solutions which satisfy the boundary conditions at the trailing end of the body. It is shown that, with weak interaction of the hypersonic flow with the boundary layer, there may be formed short areas of flows with the free interaction and local inviscous flows with large gradients of pressure, at the limits of which the disturbances can be transmitted above the flow. Author

N71-23313*# Southwest Research Inst., San Antonio, Tex.
LOW VELOCITY GAS FLOW MEASUREMENT Final Technical Report
R. L. Bass, III, T. E. Owen, C. R. Gerlach, and S. A. Suhler Feb. 1971 109 p refs
(Contract NAS8-26117; SwRI Proj. 02-2851)
(NASA-CR-103096) Avail: NTIS CSCL 20D

A program to find and evaluate new methods and techniques for low velocity measurements with emphasis on instrumentation other than hot wire anemometers is discussed. Recommendations for the best measurement principle for an instrument development program is made along with specifications and scope of such a program. Author

N71-23314# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
AN EXPERIMENTAL INVESTIGATION OF A TURBULENT JET IN A CROSS FLOW
David K. Mosher (Ph.D. Thesis) Dec. 1970 182 p refs
(Contract DAHC04-68-C-004; Proj. Themis)
(AD-718798; GIT-AER-70-715) Avail: NTIS CSCL 20/4

The interference phenomenon occurring when a subsonic turbulent jet exhausts normally from a large flat plate into a low speed crossflow was experimentally investigated in the Georgia Tech nine foot wind tunnel. Static pressures were measured on the surface around the jet. In the region off the surface, including the jet plume, wake and surrounding areas, the average total and static pressures and the average velocity magnitudes and directions were determined. Three jet exit configurations were studied, one circular and two slot-shaped with width to length ratios of 0.3 and 3.4. All have the same exit area. The effective jet to cross-flow velocity ratio was varied, for each of the exit configurations, over the range 4.0 to 12.0. Analysis of the data indicates that the pressure distributions induced on the surface are a combined result of the jets blocking and entraining effects on the cross flow with entrainment becoming the more dominant of the two as the effective velocity ratio is increased. This relative dominance brings about an attenuation of total interference lift loss (when computed as a fraction of gross thrust) primarily by causing a rise in the low pressures in the wake region as the effective velocity ratio increases. When the effective velocity ratio is held fixed, the total interference lift loss increases with increasing width to length ratio of the jet exit. Author (GRA)

N71-23321# New York Univ., N.Y. School of Engineering and Science.
ON THE SPHERICALLY SYMMETRIC PHASE CHANGE PROBLEMS Final Report
Gundi Kocamustafaogullari and Novak Zuber Jan. 1971 49 p refs
(Grant AF-AFOSR-1740-69)
(AD-718151; NYU-5513-333; AFOSR-TR-71-0139) Avail: NTIS CSCL 20/4

The objectives of this paper are: To show that the application of the thin thermal boundary layer approximation to collapsing bubbles is incorrect although this approximation has been used by all investigators interested in cavitation. To show that the available analyses based on the heat balance integral method contain a significant error because the assumed temperature profiles are incorrect when applied to a spherically symmetric problem. To solve the spherically symmetric phase change, i.e. moving boundary, problem by means of the heat balance integral method using the appropriate temperature profile. To use the results in an analysis of diffusion controlled bubble growth and collapse. Two solutions of the phase change problem are presented. Author (GRA)

N71-23385*# National Aeronautics and Space Administration, Washington, D.C.
A STUDY OF TWO-LAYER GAS FLOW IN SUPERSONIC AXISYMMETRIC NOZZLES [ISSLEDOVANIYE DVUKHSLOYNYKH TECHENIY GAZA V SVERKHZVUKOVYKH OSESIMMETRICHNYKH SOPLAKH]
U. G. Pirumov Apr. 1971 12 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza (Moscow), No. 4, Jul.–Aug. 1970 p 76–81
(NASA-TT-F-13526) Avail: NTIS CSCL 20D

Two methods of calculating two-layer flow are described. The first is a generalization of the numerical method of determining the inverse problem to the case of two-layer flows without taking mixing into consideration. The second is a method of characteristics for calculating two-layer flows in supersonic nozzles. The usual method of characteristics is modified to calculate a point on the line separating layers having different adiabatic exponents, different total pressures and temperatures. The results of calculating a two-layer flow in nozzles with different adiabatic exponent and gas flowrate ratios in the layers are also presented. Author

N71-23398# California Inst. of Tech., Pasadena. Div. of Engineering and Applied Science.
THE WALL EFFECT FOR UNSTEADY, CHOKED SUPERCAVITATING FLOW
Jong H. Kim Jan. 1971 55 p refs
(Contract Nonr-220(59))
(AD-718816; E-79A-13) Avail: NTIS CSCL 20/4

A linear theory for the two-dimensional supercavitating flow past a flat hydrofoil heaving and pitching with small amplitudes in

a choked tunnel is developed using the acceleration potential. It is supposed that the streamlines of the cavity always spring from the leading and the trailing edges of the foil and that the foil is inclined at a small angle to the oncoming flow. Also the pressure in the cavity is assumed to be constant. Force and moment coefficients are calculated as functions of reduced frequency and the ratio of tunnel height to chord length. The pressure disturbances caused by the unsteady motion in a tunnel studied far upstream; these are seen to depend on the chord-tunnel height ratio and reduced frequency. Author (GRA)

N71-23481# Ohio State Univ. Research Foundation, Columbus. Aerospace Research Labs.

COMPUTATIONAL STUDY OF SUPERSONIC FLOW OVER BACKWARD FACING STEPS AT HIGH REYNOLDS NUMBER Final Technical Report, 1 Oct. 1967 – 30 Sep. 1970

Odus R. Burggraf Nov. 1970 57 p refs

(Contract F33615-68-C-1071)

(AD-718104; ARL-70-0275) Avail: NTIS CSCL 20/4

The problem of laminar separated flow over a backward-facing step is solved numerically for the limiting case of infinite Reynolds number. The flow model adopted is that deduced by Batchelor for incompressible flow: an inviscid rotational eddy confined within the recirculation portion of the separated shear layer. It is argued that the reattachment process is essentially inviscid in the limit R approaches infinity, and the flow field in the reattachment zone is computed on this basis. The computed results support Chapmans model of the reattachment process as the correct limit case, to second-order accuracy, as the flow angle entering the reattachment zone approaches zero. For the recirculation zone, the boundary-layer equations are simplified by assuming a constant pressure eddy. The Dorodnitsyn transformation is applied and numerical solutions obtained using an implicit finite-difference scheme. The solutions are carried out from station-to-station in the direction of flow over a complete cycle of recirculation. Iteration yields the unique value of the vorticity in the inviscid layer upstream of separation, including the effects of corner expansion and recirculation on the development of the separated shear layer. Author (GRA)

N71-23482*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

A TWO SPACECRAFT TEST OF A SINGLE SPACECRAFT METHOD OF ESTIMATING SHOCK NORMALS

R. P. Lepping Mar. 1971 17 p refs Submitted for publication

(NASA-TM-X-65499; X-692-71-138) Avail: NTIS CSCL 20D

By assuming the validity of a subset of the Rankine-Hugoniot conservation relations for interplanetary (IP) shocks in an isotropic medium it was demonstrated, in principle, that improved shock normals can be calculated by using a least squares technique on combined magnetic field and plasma data from a single spacecraft. On January 26, 1968 at about 1430 U.T. this shock was observed by the plasma and magnetic field instruments on Explorers 33 and 35. The spacecraft were 76.6 and 56.9 earth radii (R) sunward of the earth respectively (and 43.5 R from each other), and therefore well outside the earth's bow shock region, a necessary condition for a valid test. It was assumed that an IP shock's surface is locally plane over dimensions of about 100 R. Using this assumption and the known geometrical configuration of the positions of the spacecraft with respect to the earth at the times of the shock onset the orientation of an observed normal was ascertained. For comparison least squares best-estimate normals were then calculated for each spacecraft using three different time intervals of data in each case: 9, 12, and 18 minutes, before and after onset. This was repeated using only the magnetic field data and the conventional coplanarity theorem for further comparison. For the 18 minute data interval it was shown that the best-estimate normals for Explorers 33 and 35 agree with each other within less than 3 deg, and correspond to the observed normal within its angular uncertainty due to the time uncertainty of the earth's sudden commencement. Author

N71-23496# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Inst. fuer Angewandte Gasdynamik.

LIGHT SCATTERING ON GASES AS A DIAGNOSTIC TOOL

Gustav Schweiger Jan. 1971 25 p refs Presented at the Euromech. 18 Colloq., Southampton, Engl., 16 – 18 Sep. 1970

(DLR-Mitt-71-01) Avail: NTIS; ZLDI Munich: 8,40 DM

A theoretical study of the different light scattering processes which can occur in gases is made. On this basis the feasibility of gas diagnostics by means of light scattering is discussed. It is shown that a local measurement of electron density, gas density, gas temperature, and species concentration should be possible under certain conditions. Author (ESRO)

N71-23539# Michigan Univ., Ann Arbor. Cavitation and Multiphase Flow Lab.

MECHANICAL CAVITATION DAMAGE PHENOMENA AND CORROSION FATIGUE

F. G. Hammitt Mar. 1971 18 p refs Presented at the Intern. Conf. on Corrosion Fatigue, Storrs, Conn., 14 – 18 Jun. 1971

(Grant NSF GK-13081)

(UMICH-003371-7-T) Avail: Issuing Activity

The details of mechanical cavitation attack are reviewed, for evaluating overall effects in a corrosive environment where cavitation is present. Numerical estimates are given for the intensity, scale, duration, and rate of repetition of surface attack from the common damaging cavitation phenomenon, i.e., individual bubble collapse. Other cavitation phenomena which are conceivably related to corrosion-fatigue are also discussed. Author

N71-23584# Virginia Polytechnic Inst., Blacksburg. Dept. of Engineering Mechanics.

NUMERICAL SOLUTIONS OF THE NAVIER STOKES EQUATIONS FOR INCOMPRESSIBLE UNIFORM FLOW PAST A PARABOLA: A STUDY OF FINITE GRID SIZE EFFECT

William C. Boswell, Jr. and Michael J. Werle Feb. 1971 48 p refs

(Contract N00014-70-C-0024)

(AD-718362; VPI-E-71-5) Avail: NTIS CSCL 20/4

Numerical solutions are obtained to the Navier-Stokes equations for the problem of flow past a parabolic cylinder in an infinite stream. The boundary conditions at infinity have been applied at finite distances and the effects studied and compared with recent works. It was found that finite boundaries had small, but noticeable effects on the wall shear, and more marked influence on the internal flow structure. Author (GRA)

N71-23585# California Inst. of Tech., Pasadena. Div. of Engineering and Applied Science.

WATER TUNNEL INVESTIGATIONS OF SCALE EFFECTS IN CAVITATION DETACHMENT FROM SMOOTH SLENDER BODIES AND CHARACTERISTICS OF FLOW PAST A BI-CONVEX HYDROFOIL

Vijay H. Arakeri Jan. 1971 79 p refs

(Contract Nonr-220(59))

(AD-718364; E-79A.12) Avail: NTIS CSCL 13/10

Experimental results concerning force coefficients and cavity detachment points under various cavitating conditions on two geometrically similar bi-convex hydrofoils are presented. A linearized cavity flow theory with cavitation separation points determined from the assumption of smooth separation at the detachment point is presented and a comparison is made of these theoretical results with the experiments. Scaling problems with cavitation separation from smooth slender bodies are discussed. With the help of photographic studies three different types of cavitation separation from smooth bodies are proposed. Author (GRA)

N71-23590# Naval Postgraduate School, Monterey, Calif.
VELOCITY DETERMINATIONS IN PULSATING PIPE FLOWS
Byron Paul Whitehurst (M.S. Thesis) Dec. 1970 51 p refs
(AD-718341) Avail: NTIS CSCL 20/4

A study of the fluctuating velocity field in the developing region of a pulsating pipe flow is presented. Theoretically, three separate determinations of radial and axial perturbation velocity profiles were calculated involving varying degrees of analytical simplification. Experimentally, pulsating disturbances were created by a sinusoidal pressure wave exciter installed at the outlet of a 1.5 inch circular wind tunnel facility. Cross-wire anemometer measurements of the pulsating velocity components compared favorably with the parallel theoretical results. Likewise, experimental determinations of the phase angles between velocity and pressure signals compared favorably with analytical values. Author (GRA)

N71-23591# Naval Ship Research and Development Center, Washington, D.C.
UNSTEADY HYDRODYNAMIC LOADS ON A TWO DIMENSIONAL HYDROFOIL Final Report
John H. Pattison Nov. 1970 150 p refs
(AD-717953; NSRDC-3245) Avail: NTIS CSCL 13/10

Unsteady hydrodynamic lift, moment, and drag on a two-dimensional NACA 16-209 hydrofoil are determined experimentally as functions of depth of submergence, forward speed, mean angle of attack, and frequency of oscillation in pure heave and pure pitch motions. Various theoretical and experimental results are compared with the experimental steady and unsteady load coefficients on the hydrofoil model. The comparisons include both finite and zero forward speed effects. Added-mass coefficients are obtained from the zero forward speed case. Theoretical and experimental results do not agree because of limitations in both the theories and experiments. Author (GRA)

N71-23665 Pennsylvania State Univ., University Park.
TURBULENT FLOW AND ROUGHNESS CHANGE
Ernest Walter Peterson (Ph.D. Thesis) 1969 83 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 70-7239

A theory is developed which describes the adjustment of the flow of hydrostatically neutral air in the lower portion of a fully developed turbulent boundary layer after an abrupt change in surface roughness perpendicular to the direction of the flow, on an otherwise homogeneous plane. The flow is assumed stationary; upstream of the terrain change it is assumed to be in equilibrium with the surface roughness. The stress distribution upstream of the surface discontinuity is assumed to be independent of height. With the hypothesis that the horizontal shear stress is proportional to the turbulent energy, a theory is developed which postulates the flow to be primarily governed by the dominant terms of the horizontal-momentum, continuity, and turbulent-energy equations. The influence of pressure changes is neglected. The predicted transition velocity-profiles differ distinctly from previous models in that they contain an inflection point. Dissert. Abstr.

N71-23676# Scientific Translation Service, Ann Arbor, Mich.
ON THE PROBLEM OF THE ATOMIZATION OF A LIQUID BY A HIGH VELOCITY GAS STREAM
E. M. Kunina et al Dec. 1970 5 p refs Transl. into ENGLISH from Inzh. Fiz. Zh., Akad. Nauk Belorussk. SSR (Minsk), v. 19, 1970 p 116-119 Prepared for Argonne Natl. Lab.
(ANL-TRANS-871) Avail: NTIS CSCL 20D

It is shown that when estimating dust sedimentation on drops formed in liquid atomization by a high-velocity gas stream, it is necessary to use the most probable dimension of the drop rather than the Sauter diameter. Formulas are obtained for determination of the radius, relating it to the Sauter diameter. A plot of the radius versus the relative velocity between the gas, the drops, and the amount of atomized liquid is plotted. Author

N71-23685# Naval Postgraduate School, Monterey, Calif.
A NUMERICAL INVESTIGATION OF FINITE AMPLITUDE DISTURBANCES IN A PLANE POISEUILLE FLOW
George Donoghue O'Brien (Ph.D. Thesis) Jun. 1970 207 p refs
(AD-718308) Avail: NTIS CSCL 20/4

A consistent and stable finite-difference approximation of the vorticity transport equations was applied to a plane Poiseuille flow with spatially periodic disturbances of finite amplitude. By application of the discrete Fourier transform to the solution of a Poisson equation, significant improvements in the speed and accuracy of the calculations were obtained. Numerical tests indicate that the usual iterative schemes are inadequate if a large number of mesh points are employed. The effect of mesh size was determined by extensive calculations based on a consistent second-order representation of the linear eigenvalue problem. The results indicate that a fine mesh is required to accurately represent the behavior of even the large-scale unstable motions. The stability and accuracy of the present formulation was demonstrated, in the linear range, by comparison with the established results of the linear theory. Calculations in the non-linear range, at a moderate value of the Reynolds number, indicate the existence of an equilibrium state. The calculated values of the mean spectral density of kinetic energy are consistent with the exponential law predicted by Kraichnan for two-dimensional turbulence. The program, developed in this investigation, provides a means, of demonstrated accuracy, for the extensive investigation of two dimensional turbulence in a shear flow. Author (GRA)

N71-23702*# Scientific Translation Service, Santa Barbara, Calif.
THE EFFECTS OF FLOW CONTAINING DUST ON THE RESULTS OF HYPERSONIC WIND TUNNEL EXPERIMENTS [VLIYANIYE ZAPYLENNOSTI POTOKA NA REZUL'TATY ISPYTANIYV GIPERZVUKONUKH AERODINAMICHESKIKH TRUBAKH]
B. I. Bakum et al Washington NASA Apr. 1971 7 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekhan. Zhidkosti i Gaza (Moscow), no. 4, Jul.-Aug. 1970 p 187-189
(Contract NASw-2035)
(NASA-TT-F-13529) Avail: NTIS CSCL 20D

The influence of flow containing dust upon aerodynamic experiments in hypersonic wind tunnels is considered. It is found that there is an increase in drag for thin profiles, and a drag decrease for blunt profiles. Author

N71-23703# Israel Program for Scientific Translations, Ltd., Jerusalem.
VISCOSITY OF GASES AND GAS MIXTURES: A HANDBOOK
I. F. Golubev 1970 245 p refs Transl. into ENGLISH of the book "Vyazkostgaz. i Gaz. Smesei. Spravochnoe Rukovodstvo" Moscow, Gos. Izd. Fiz.-Mat. Lit., 1959 245 p Sponsored in part by Interior Dept. Prepared in cooperation with NSF
(TT-70-50022) Copyright. Avail: NTIS CSCL 01A

Contents: Viscosity of gases: Measurements of gas viscosity: Experimental results: The viscosity of gases at atmospheric pressure: The viscosity of compressed gases: The viscosity of gas mixtures. GRA

N71-23708*# Scientific Translation Service, Santa Barbara, Calif.
RELAXATION AND NONEQUILIBRIUM RADIATION BEHIND SHOCK WAVES IN AIR [RELAKSATSIYA I NERAVNOVESNOYE IZLUCHENIYE ZA UDARNYMI VOLNAMI V VOZDUKHE]
M. B. Zheleznyak et al Washington NASA Apr. 1971 31 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekhan. Zhidkosti i Gaza (Moscow), no. 4, Jul.-Aug. 1970 p 161-174
(Contract NASw-2035)
(NASA-TT-F-13528) Avail: NTIS CSCL 20D

Relaxation behind shock waves in air at velocities from 8 to 12 km/sec is considered. Gas parameter profiles behind the

front are obtained and population densities of radiative states of atoms and molecules are calculated. It is found that radiation intensity passes through a maximum exceeding the equilibrium level in a series of spectrum intervals. Comparisons are made with experimental data obtained in shock tubes and radiant heat fluxes from the relaxation zone are computed. The contribution of this radiation to radiation heating of immersed bodies in hypersonic flows is evaluated. Author

N71-23724# Imperial Coll. of Science and Technology, London (England). Dept. of Mechanical Engineering.

HYDRODYNAMIC CHARACTERISTICS OF THE FULLY DEVELOPED LAMINAR FLOW IN TUBES CONTAINING TWISTED TAPES: A NUMERICAL STUDY

A. W. Date Nov. 1970 43 p refs
(EF/TN/A/32) Avail: NTIS

Full, elliptic, partial differential equations of the Newtonian fluid motion are solved in a rotating co-ordinate system to predict the hydrodynamic characteristics of the fully developed, laminar, uniform-property flow in a circular tube containing a twisted-tape. The derivation of the necessary equations and the method employed for their solution, are briefly described. Mathematical aspects like accuracy, convergency and stability of the method of solution are also considered. It has been shown that the equations belong to a two-parameter family, the parameters being the Reynolds number(Re) and the twist-ratio y (i.e. ratio of pitch of tape to diameter of tube). The computed predictions of friction factor, and of profiles of axial velocity, stream function and axial vorticity are presented for different values of Re and y. Author

N71-23757# Princeton Univ., N.J.

A STUDY OF TURBULENT BOUNDARY LAYER MODELS. PART 2: MEAN TURBULENT FIELD CLOSURE

George L. Mellor and H. James Herring Jan. 1971 47 p refs Sponsored by AEC Prepared for Sandia Corp., Albuquerque, N.Mex. Supercedes SC-CR-70-6125
(SC-CR-70-6125B-Pt-2) Avail: NTIS

In order to close the mean velocity equations appeal is made to the mean turbulent equations of motion obtained by taking the first moment (in velocity) of the Navier-Stokes equations. To close the resulting equation set, assumptions are required, the consequence of which was labeled mean turbulent field closure. Whenever possible, an attempt at supplying a rational basis for each assumption is made. The central hypothesis is that already proposed by Rotta. Various simplified submodels may be identified including mean velocity field closure. Author

N71-23796*# Techtran Corp., Glen Burnie, Md.

LAMINAR BOUNDARY LAYER ON A WING AND A BODY OF REVOLUTION IN THE PRESENCE OF BLOWING [LAMINARNYY POGRANICHNYY SLOI NA KRYLE I TELE VRASHCHENIYA PRI NALICHII VDUVANIYA]

L. F. Kozlov et al Washington NASA Apr. 1971 12 p refs Transl. into ENGLISH from Samoletostr. Tekh. Vozdush. Flota (USSR), no. 17, 1970 p 19–25
(Contract NASw-2037)
(NASA-TT-F-13627) Avail: NTIS CSCL 20D

A method is developed for calculating the characteristics of a two dimensional axisymmetric incompressible boundary layer on a blown wing, using a sixth-order polynomial for approximating the velocity distribution across the boundary layer. An arbitrary velocity distribution at the outer boundary of the layer is assumed. A solution to the problem is obtained with the aid of Karman's integral relation. The method can be readily extended to the calculation of blown laminar boundary layers on bodies of revolution. Author

N71-23826# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.

A RE-EXAMINATION OF SOME RETRANSITIONAL FLOWS

G. David Huffman Mar. 1971 31 p refs
(IC-71-06) Avail: NTIS

Computational techniques for a wide range of retransitional flows are submitted. Inner layer similarity, the equivalence of production and dissipation, and a dissipation length scale are employed to develop a correlation between a characteristic viscous length and shear stress gradient. The correlation is valid for a number of flows ranging from axisymmetric wall jets to two dimensional boundary layers. Author

N71-23827# Imperial Coll. of Science and Technology, London (England).

REMOVAL OF AN INSTABILITY IN A FREE CONVECTION PROBLEM

L. S. Caretto, A. P. Gosman, and D. B. Spalding Mar. 1971 22 p refs Presented at the Conf. on Appl. of Numerical Analysis, Dundee, Scotland, 23–26 Mar. 1971
(EF/TN/A/35) Avail: NTIS

Using pressures and velocities as the principal variables, computational methods were developed for problems in steady fluid flow and heat transfer. An instability in this scheme, due to interlinkages between the flow and energy equations, was discovered when the solution was applied to the problem of buoyancy in a stably-stratified fluid. This instability was removed by devising a special underrelaxation procedure for the temperature equation. Further computations revealed a second instability which arises when too large a perturbation is applied to a zero flow situation. Author

N71-23922*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.

COMPARISON OF WIND TUNNEL AND FLIGHT-MEASURED BASE PRESSURES FROM THE SHARP-LEADING-EDGE UPPER VERTICAL FIN OF THE X-15 AIRPLANE FOR TURBULENT FLOW AT MACH NUMBERS FROM 1.5 TO 5.0

Sheryll A. Goecke Washington May 1971 38 p refs
(NASA-TN-D-6348; H-602) Avail: NTIS CSCL 20D

Pressures measured at six locations on the base of the sharp-leading-edge upper vertical fin of the X-15 airplane during the power-off portion of eight flights are compared with previous flight data obtained from a blunt-leading-edge fin, theory, and wind tunnel data. The flight and wind tunnel base pressure ratios for the Mach number range from 1.5 to 5.0 are presented as a linearized function of turbulent boundary-layer height and base width by using a Mach-number-dependent factor derived in the study. The resulting curve seems to provide another criterion for determining whether flow is laminar or turbulent. The difference between base pressure and free-stream pressure for any specific Mach number of the study is found to be a linear function of both free-stream pressure and dynamic pressure. Data from the sharp-leading-edge upper vertical fin agree with data from the blunt-leading-edge upper vertical fin. The flight data show the variation in pressure across the base to be negligible. Author

N71-23923*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EFFECTS OF INTERPHASE TEMPERATURE DIFFERENCES AND WALL FRICTION IN HIGH-TEMPERATURE HEAT PIPES

Peter M. Sockol Washington Apr. 1971 22 p refs
(NASA-TM-X-2268; E-6126) Avail: NTIS CSCL 20D

From the analysis of a simple evaporation-heat-transfer system it is shown that the temperature drop required by the second law of thermodynamics occurs at the liquid-vapor interfaces. The temperature drop is estimated for conditions comparable to those in a 30-kW, 1800 K lithium heat pipe. A simple one-dimensional treatment of the fluid dynamics in a high-temperature heat pipe is used to predict pressure drops in such a pipe. The effects of evaporation and condensation on wall friction

in turbulent flow are included in the analysis. The additional friction due to condensation is shown to reduce the pressure recovery by a factor of 2. Detailed calculations are presented for two 1800 K lithium heat pipes. Author

N71-23948 Oregon State Univ., Corvallis.
ESTIMATION OF MOMENTUM, HEAT AND MASS TRANSFER IN LAMINAR BOUNDARY LAYERS
Gary Allen Myers (Ph.D. Thesis) 1970 204 p
Avail: Univ. Microfilms: HC $9.25/Microfilm $3.00 Order No. 70-9900

Sisson's formally exact series solution for momentum, heat and mass transfer in steady two-dimensional or axisymmetrical constant-property, laminar boundary layer flow was examined. A new series was proposed for the boundary condition accounting for the mass transfer at the surface of the body on which the boundary layer is formed. This series circumvents certain anomalies experienced by the original method and improves the accuracy of the solutions for those flows with suction occurring at the wall. The method of Sisson was found to agree with exact theory for limits of large suction and limits of small Prandtl or Schmidt numbers with little or no mass transfer at the wall. The exact limit of large Prandtl or Schmidt numbers with little or no mass transfer at the surface was approached very closely by the Sission similar method. Dissert. Abstr.

N71-23953*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SURFACE-FLOW VISUALIZATION INVESTIGATION OF A DELTA WING SHUTTLE CONFIGURATION AT A MACH NUMBER OF 7.4 AND SEVERAL REYNOLDS NUMBERS
H. Lee Seegmiller Jun. 1970 56 p refs
(NASA-TM-X-62036) Avail: NTIS CSCL 20D

Surface-flow visualization photographs are presented for a model of a delta wing shuttle concept. An oil flow technique was used to visualize the surface flow at a Mach number of 7.4 and several Reynolds numbers between 1,400,000 and 5,700,000. Angles of attack from 15 deg to 60 deg were tested at zero sideslip. A sideslip angle of 5 deg was also tested at an angle of attack of 15 deg. Details of the surface patterns are shown which illustrate the complexity of the hypersonic flow. Author

N71-24134 Rutgers Univ., New Brunswick, N.J.
STUDIES IN STRATIFIED FLOW
John Vincent Droughton (Ph.D. Thesis) 1969 147 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 70-10060

The flow of a density-stratified fluid about symmetric towed bodies was investigated both experimentally and theoretically. A cylinder and a slender body were towed through a linearly stratified fluid at various depths and the resulting lee waves were observed and recorded photographically in such a manner as to show the flow tracers as streamlines of the flow. The effect of a linear density gradient on the stability of the time-dependent flow induced by an impulsively started cylinder with horizontal axis of rotation was experimentally investigated along with the effect of the instabilities on the flow far from the cylinder. It was observed that the density gradient serves to inhibit the formation of the Taylor instabilities and alters their shape from circular to elliptical. A strong Richardson number dependence for stability was exhibited in stratified fluids. The axial spacing of the instabilities was not observed to be affected by the presence of a density gradient. Dissert. Abstr.

N71-24135 Stanford Univ., Calif.
SUPERSONIC FLOW OVER AN OGIVE OF REVOLUTION: AN EXAMPLE OF A BOUNDARY LAYER UNDER SINGULAR OUTER CONDITIONS
Stephen Joseph Stahara (Ph.D. Thesis) 1969 89 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 70-10531

The steady, axisymmetric, supersonic flow past an ogive of revolution is investigated by using the method of matched asymptotic expansions. This is an example of a boundary layer in the presence of a singular outer flow. The inviscid solution is calculated by expanding about the Taylor-Maccoll solution for a cone in integral powers of the radial coordinate. The first perturbation indicates that the inviscid solution is nonanalytic in the coordinate normal to the body surface, with the outer vorticity having an inverse half-power singularity at the body surface. The boundary layer expansions that are generated by this outer flow are found to proceed in inverse quarter-powers of the Reynolds number rather than the usual inverse half-powers with self-similar solutions being possible. The nonanalytic behavior of the outer flow causes an apparent algebraic decay of vorticity in the boundary layer and this point is discussed and clarified in view of higher order corrections. Numerical results are presented for several selected cases. Dissert. Abstr.

N71-24136 Idaho Univ., Moscow.
NONISOTHERMAL MHD DUCT FLOW
William Joseph Thompson (Ph.D. Thesis) 1969 166 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 70-10711

The partial differential equations describing the simultaneous transport of momentum, energy and magnetic field, are derived for fully developed MHC flow in finite ducts. The fluid properties are allowed to vary to the extent that electrical conductivity and viscosity are assumed to be temperature dependent. For heated or cooled electrically insulating walls, numerical solutions are obtained by utilizing a modified Gauss-Siedel algorithm. It is shown that consideration of variable fluid properties results in friction factors and bulk flow rates which differ from constant property solutions by as much as a factor or two, and by fifty percent even for small variations. For ducts operated as electromagnetic flow meters, variable fluid properties produce flow meter sensitivities thirty percent above ideality for cooling at the walls, and up to sixty percent below ideality for heated walls. Dissert. Abstr.

N71-24140*# Purdue Univ., Lafayette, Ind. Fluid Mechanics Group.
EXAMINATION OF TURBULENT SHEAR MODELS AND THE PREDICTION OF COMPRESSIBLE TURBULENT BOUNDARY LAYERS BY THE METHOD OF WEIGHTED RESIDUALS
Gail R. Deboy and Douglas E. Abbott Jan. 1971 189 p refs
(Grant NGT-15-005-005; Proj. 2074)
(NASA-CR-118079; FMTR-71-1) Avail: NTIS CSCL 20D

Shear models are studied both as they influence a given boundary-layer prediction scheme and also as they yield shear-stress profiles independent of prediction methods. Shear-stress calculations are then examined as reported by previous workers, as calculated from the intermediate boundary-layer results of other methods, and as computed in the present investigation. It is found that the behavior of many of the shear models is qualitatively incorrect in terms of their prediction of the shear-stress distribution. The cause of the anomalous behavior of the shear-stress profiles is discussed in relation to the specific shear models, and the effects of this behavior on boundary-layer prediction programs are examined. The computational advantages of the method of weighted residuals are compared with those of finite-difference methods and those of the conventional integral methods. Since the method of weighted residuals is found to possess many of the advantages of the other two methods, it is extended to the solution of the compressible, turbulent boundary-layer equations. Author

N71-24141# National Bureau of Standards, Washington, D.C.
HYDRAULIC RESEARCH IN THE UNITED STATES, 1970
Gershon Kulin and Pauline H. Gurewitz, eds. Mar. 1971 356 p
(NBS-SP-346) Avail: SOD $2.50

Current and recently concluded research projects in hydraulics and hydrodynamics for the years 1969 to 1970 are summarized. Projects from more than 250 university, industrial, state, and federal laboratories in the United States and Canada are reported. Author

N71-24156 Kansas Univ., Lawrence.
THE DEGRADATION OF DRAG REDUCING ADDITIVES IN TURBULENT PIPE FLOW
Frank J. Eichstadt (Ph.D. Thesis) 1969 166 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 70-11018

Drag reduction data on a polymer solution at various stages of degradation in a long pipe line are presented. The simulation of the long pipe line was done by making several passes in a 0.43 inch I.D. by 20 foot stainless steel test section in a blow down flow system. A comparison of the multipass data to long pipe line data shows that the drag reduction ratios obtained from the multi-pass data are low by as much as 20%. This was attributed to degradation in the inlet/exit regions of the multi-pass flow system. A sharp inlet contraction causes more degradation than a conical inlet reducer. Drag reduction data were taken on 10, 25, 50, 75, and 250 wppm aqueous Polyox WSR 301 solutions in a 0.43 inch by 120 foot long pipe line. Three methods were used to reduce the bulk of the drag reduction data to a more usable and/or meaningful form. Dissert. Abstr.

N71-24157 Lehigh Univ., Bethlehem, Pa.
A STUDY INVOLVING FLOW BOILING PEAK PRESSURE DROPS AND MAXIMUM TWO PHASE FLOW
John Best Durkee, II (Ph.D. Thesis) 1969 182 p
Avail: Univ. Microfilms: HC $8.40/Microfilm $3.00 Order No. 70-10592

A mathematical model for the prediction of maximum two-phase flow rates and the comparison of maximum two-phase flow rates with flow rates where a peak in pressure drop was observed are presented. The system in which the conditions of peak pressure drop were measured was a heated, low-pressure, rigid, closed boiling system. Mass flow rates at which a peak in pressure drop across a one-half diameter, horizontal boiling channel occurred were measured as a function of the heat flux to the boiling channel and the temperature of the subcooled liquid inlet to the channel. At constant rate of heat addition and inlet temperature, there was an increase in total pressure throughout and upstream of the boiling channel as the mass flow rate was increased beyond that value found at the pressure drop peak. This departure of the pressure at the discharge for the pressure downstream from the discharge suggested the possibility that the flow rate at the pressure drop peak was a maximum flow rate. Dissert. Abstr.

N71-24158 Stanford Univ., Calif.
VISCOMETRIC PROPERTIES OF VISCOELASTIC FLUIDS
Calvin Arnold Bruce (Ph.D. Thesis) 1969 189 p
Avail: Univ. Microfilms: HC $8.60/Microfilm $3.00 Order No. 70-10433)

An experimental study of the elastic and viscous properties of several polymer systems was undertaken. The general continuum mechanics approach to materials was first used both to describe the experiments and to provide valid constitutive equations for certain operating conditions. Next the specific predictions of the various molecular models and correlation technique were considered. Most of the steady shearing data were taken with the Weissenberg rheogoniometer, using the cone-and-plate and parallel-plate flow geometries. In this manner, for a simple shearing flow, the viscosity function and two normal stress functions and were measured as functions of strain rate for each sample. Data were taken in the molten state for three different molecular weight silicones and two polyisobutenes. Dissert. Abstr.

N71-24159*# Scientific Translation Service, Santa Barbara, Calif.
A STUDY OF THE INTERACTION OF A SUPERSONIC JET AND AN ACOUSTIC FIELD [ISSLEDOVANIYE VZAIMODEYSTVIYA SVERKHZVUKOVOY STRUI S AKUSTICHESKIM POLEM]
M. G. Lebedev et al Washington NASA Mar. 1971 24 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza (Moscow), no. 4, Jul.–Aug. 1970 p 82–94
(Contract NASw-2035)
(NASA-TT-F-13527) Avail: NTIS CSCL 20D

The theory of Pulsations in the wake of a supersonic nozzle is developed. The mechanism of this phenomenon is discussed on the basis of previous experimental and theoretical works. Author

N71-24162*# Translation Consultants, Ltd., Arlington, Va.
CONDITIONS OF FORMATION OF A WATER FILM ON THE HIGHWAY AND ITS EXPULSION OWING TO ACTION OF A TIRE [CONDITIONS DE FORMATION D'UN FILM D'EAU SUR LA CHAUSSEE ET DE SON EXPULSION SOUS L'ACTION D'UN PNEUMATIQUE]
J. Lefranc Washington NASA May 1971 86 p refs Transl. into ENGLISH from Lab. Central des Ponts et Chaussees (France), May 1969 81 p
(Contract NASw-2038)
NASA-TT-F-13603) Avail: NTIS CSCL 20D

Studies show that the traction of a tire decreases quickly when the thickness of the water film encountered by the tire tread during its movement increases. There is, on this basis, some advantage in knowing well the orders of magnitude of the water thicknesses which are formed during a rain on a particular highway or airport runway. The development of a neutron probe allowed these measurements to be carried out with an accuracy better than 1/10 of a millimeter. In this way, water films of 1 - 2 mm (with the equivalent of a rain 40 mm/hr) could be observed during their drainage down to 0.1 - 0.5 mm. These developments in time allowed a clear differentiation to be made between the draining capacities of two airport runways, one transversely grooved and the other conventional. It is found that the various hydrodynamic modes can be depicted by one or several relations which appear to be specific elements of the gradual development of film thickness as a thin flow. Author

N71-24208# Arizona Univ., Tucson. Energy Mass and Momentum Transfer Lab.
LAMINAR LOCAL WALL FRICTION AND HEAT TRANSFER IN NONCIRCULAR TUBES AND ANNULI WITH VARIATION OF GAS TRANSPORT PROPERTIES Final Report, 16 Feb. 1965–31 Jan. 1971
Donald M. McEligot Jan. 1971 11 p refs
(Contract DA-31-124-ARO(D)-314)
(AD-718777; AROD-5403-15-E-) Avail: NTIS CSCL 20/4

Numerical solutions - of the property coupled, parabolic system of partial differential equations representing conservation of mass, momentum and thermal energy - were obtained for a flow of gases in circular tubes, annuli, and between parallel plates. Circular tube predictions were verified in the laboratory. Experiments were also conducted with tubes of rectangular cross-section. In all cases, the effects of gas property variation on heat transfer parameters are slight but the predictions of wall friction are modified substantially. The studies were extended to include low Reynolds number turbulent flow, high Reynolds number turbulent flow of gases with strong property variation, and transition of high molecular eight polymer solutions. Author (GRA)

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N71-23128*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NUMERICAL CALCULATIONS OF THE WIND DRIVEN CURRENTS IN LAKE ERIE AND COMPARISON WITH MEASUREMENTS
Richard T. Gedney and Wilbert Lick (Case Western Reserve Univ.) [1971] 28 p refs Presented at 14th Great Lakes Res. Conf., Toronto, 19 Apr. 1971; sponsored by Toronto Univ. and Intern. Assoc. for Great Lakes Res. Sponsored in part by NSF
(NASA-TM-X-67804) Avail: NTIS CSCL 08H

The steady-state, wind driven velocities in Lake Erie were calculated numerically using a shallow lake model. The three-dimensional velocities as a function of depth and horizontal position are displayed for the prevailing southwest winds. The results show that the velocities vary greatly from position to position and depend strongly on the bottom topography and boundary geometry. For the numerical calculations, a 0.805 kilometer grid size in an island region and a 3.22 kilometer grid size in the rest of the lake had to be incorporated to adequately represent the Lake Erie geometry. The calculated velocities compare quantitatively very well with current meter measurements made at mid-depths in the Central and Eastern basins. The magnitudes of the average eddy viscosity used in the calculations agree with measurements made in the Great Lakes. Steady currents are shown to usually occur after two days of fairly uniform winds. Author

N71-23179# Joint Publications Research Service, Washington, D.C.
OCEANOGRAPHY
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 249 31 Mar. 1971 p 16-18 (See N71-23176 12-30)
Avail: NTIS

Internal wave, trade wind, and ocean bottom studies are reported. A geomorphological atlas containing underwater photographs of the Pacific Ocean bottom is reviewed, and mantle rock is reported to be recovered from the Pacific floor. Internal waves in the Sargasso Sea, and internal wave generation from periodic surface disturbances are described. General circulation and quantitative characteristics of the trade winds in the Atlantic are also mentioned. N.E.N.

N71-23180# Joint Publications Research Service, Washington, D.C.
TERRESTRIAL GEOPHYSICS
In its Soviet Bloc Res. in Geophys. Astronomy, and Space, No. 249 31 Mar. 1971 p 19-28 (See N71-23176 12-30)
Avail: NTIS

Abstracted and news data on seismology, geomagnetism, and earth structure are presented. Seismic wave propagation and attenuation, microseisms in the Antarctica, and the 1960 Yavrozskoye earthquake are described. Anomalous magnetic characteristics, magnetic variations, and gravity anomalies in the Black Sea are discussed, and superdeep borehole findings, magnetotelluric soundings, and geothermal studies are reviewed. Crustal structure of islands arcs, the rift zone in the Indian Ocean, earth tides in Kungurskaya ice cave, and IR aerial surveys of moist ground and ground water are also described. N.E.N.

N71-23199 Interior Dept. Washington, D.C.
RIVER OF LIFE, WATER: THE ENVIRONMENTAL CHALLENGE
1970 87 p *Its* Conservation Yearbook Series, Vol. 6
Avail: SOD $2.00

A discussion is presented on the water resources of the United States, the hydrologic cycle, and the importance of water in the total environment. Water rich and water poor areas, man-made pollution, and water quality control are described. Water for fish, wildlife, man's recreation, and man's personal and industrial needs are considered as well as the delicate balance among them. The special problems of islanders and Indians are also discussed. N.E.N.

N71-23244# Stanford Research Inst., Menlo Park, Calif.
SCALING PROBLEMS OF WAVE PROPAGATION IN ROCKS Final Report 1 May 1969-30 Sep. 1970
Carl F. Petersen, Donald R. Grine, and William J. Murri 30 Sep. 1970 38 p refs
(Contract DASA01-69-C-0143; ARPA Order 1317)
(AD-718891; DASA-2579) Avail: NTIS CSCL 8/7

Propagation of large-amplitude plane waves was studied in rock specimens from 1/2 to 12 inches thich using in-material piezoresistive stress gages. Sioux quartzite, charcoal black granite, and Coconino sandstone were examined. Good records were obtained in the granite experiments, allowing separation of the precursor from the main wave to be observed at five successive locations in a single experiment. It is concluded that time-dependent effects on wave propagation in quartzite and granite are not significant over these distances. Two experiments in granite, with open cracks, one dry and one water-filled, displayed the effect of the crack in erasing the precursor. The erasure was more complete than expected by simple theory, especially in the case of the water-filled crack. Author (GRA)

N71-23275# Army Foreign Science and Technology Center, Washington, D.C.
RADAR PROBING OF THE TROPOSPHERE UNDER CLEAR SKY CONDITIONS [NEKOTORYYE VOPROSY RADIOLOKATSIONNOGO ZONDIROVANIYA TROPOSFERY PRI YASNOM NEBE]
G. B. Brylev 19 Oct. 1970 25 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 231, 1968 p 38-54
(AD-717897; FSTC-HT-23-085-70) Avail: NTIS CSCL 4/1

At the present time, several types of radar reflections in the cm range in the absence of hydrometeors are well known. These include the following: (1) a discrete - coherent radioecho; (2) reflection from inversion layers; (3) reflection from layers with aerosol; reflection from zones of turbulence. This article considers a series of questions concerning the sources of reflections of each type and the peculiarities of the appearance of such signals. Author (GRA)

N71-23303# Army Topographic Command, Washington, D.C.
AN INVESTIGATION OF THE ACCURACY OF MULTIQUADRIC EQUATIONS OF TOPOGRAPHY
Paul Dennis Brooks Mar. 1971 106 p refs
(AD-718038; TOPOCOM-TR-1-4) Avail: NTIS CSCL 8/2

A new technique has been developed in representing topography by the summation of equations of quadric surfaces having unknown coefficients. This study tested the conic multiquadric equation of topography for eight geomorphologically diversified areas. Data points were selected for two modes of operation; significant points on a surface and a grid pattern. The criterion for evaluating the accuracy of the computed surfaces was the United States National Map Accuracy Standards. Four hyperboloid multiquadric equations were also tested to show their justification as one of the many possibilities for computing multiquadric surfaces. Author (GRA)

N71-23304*# Translation Consultants, Ltd., Arlington, Va.
GEOGRAPHY OF THE INFRARED EMISSION LAYERS IN THE UPPER ATMOSPHERE (ACCORDING TO COSMOS 65 DATA) [O GEOGRAFII SLOYEV INFRAKRASNOGO IZLUCHENIYA VERKHNEY ATMOSFERY (PO DANNYM ISZ KOSMOS-65)]
M. N. Markov Washington NASA Apr. 1971 17 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 8, no. 6, 1970 p 904-914
(Contract NAS2-2038)
(NASA-TT-F-13600) Avail: NTIS CSCL 04A

An analysis of the results of an experiment performed on board Cosmos 65 on April 17, 1965 at heights between 90 and 300 km is presented. It was found that upper atmospheric regions generating IR radiation are nonuniformly disturbed over the earth's globe. These regions are to be found at equatorial, polar, and midlatitudes but mostly in the equatorial region. In the case of an unperturbed atmosphere (k sub p = 0), the area covered by the generating regions is roughly equal to one tenth of the earth's surface. The generating regions have a stratified structure, the strata varying in thickness from 5 to 30 km. Ray structures are encountered in the polar regions. A substantial contribution of electric fields to the generation of IR radiation in the upper atmosphere is revealed. Author

N71-23305# Hawaii Inst. of Geophysics, Honolulu.
A REPORT ON THE PROCESSING OF AIRCRAFT EXPENDABLE BATHYTHERMOGRAPH DATA Final Interim Technical Report, 1 Jan. 1968 – 31 Dec. 1970
Richard C. Latham 15 Jan. 1971 44 p
(Contract N00014-67-A-0387-0004)
(AD-718393; ITR-5) Avail: NTIS CSCL 8/10

The temperature profiles obtained by Aircraft Expendable Bathythermographs (AXBT) on a flight from Oahu to Kodiak on 18 March, 1970, are presented together with the temperature section and the sound velocity section obtained by calculation using probable salinity values as derived from other sources. The resulting near-surface, short-range sound transmission conditions are described and their relative importance in the long-range transmission of sound is discussed. A detailed description is provided of the method which has been developed to plot temperature profiles from the magnetic tape record of AXBT drops with output accuracy of one-tenth degree Celsius at each four meters of depth. The increase in accuracy and the savings in manpower and time are significant. The quickly-achieved graphic display of the temperature profile permits ready analysis of the AXBT record. Author (GRA)

N71-23322# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SPECTRA OF SEISMIC WAVES FROM UNDERGROUND EXPLOSIONS FROM OBSERVATIONS IN THE NEAR ZONE
N. V. Kuzmina 20 Nov. 1970 27 p refs Transl. into ENGLISH from Vzryvnoe Delo (Moscow), no. 64, 1968 p 240–261
(AD-717880; FTD-HC-23-594-70) Avail: NTIS CSCL 8/11

Analysis of frequency spectra for ground oscillations in the near zone of an explosion indicates a simple shape with a simple well-defined maximum at 1.2-2 hertz. The frequency of the maximum is but two-thirds to one-half the apparent frequency of the domal uplift of the ground. Analysis of soil displacement relative to distance makes it possible to outline the near zone of the explosion, where nonelastic deformation takes place. The frequency spectra from eruptive explosions differ from similar spectra of underground (confined) explosions in width, amplitude, and frequency of the maximum. The relative width of the R-wave spectrum for confined explosions is about 80 to 90 percent that for explosions with ejected material. The frequencies of the maximums are 1.5-2.2 and 1.7-4.6 hertz, respectively. Frequency of the spectral maximum differs from the visible frequency by 20-30 percent. The velocity spectra for longitudinal waves change in frequency of the maximum, depending on size of charge: from 9 to 17 hertz for confined underground explosions, from 4 to 23 hertz for cratering explosions (with ejecta). Author (GRA)

N71-23326# Texas A&M Univ., College Station. Dept. of Oceanography.
OCEANOGRAPHIC EXPERIMENT SUPPORT: REMOTE SENSING OF COASTAL OCEANS Annual Report, May 1969 – May 1970
Luis R. A. Capurro 10 May 1970 143 p refs
(Contract N62306-69-C-0263)
(AD-717936; A/M-Ref-70-20A) Avail: NTIS CSCL 8/10

Contents: The present status of the uses of microwave raiometry in making meaningful oceanographic observations; International program - general; International program - Mexico; International program - Brazil; Analysis of Apollo 9 photography; and Upwelling detection from space photography. GRA

N71-23351# Arctic Inst. of North America, Washington, D.C.
TOWARD AN OPERATIONAL TECHNOLOGY FOR THE ARCTIC BASIN
1970 72 p refs
(Contract N00014-70-A-0219-0001)
(AD-717967; AINA-TR-5) Avail: NTIS CSCL 8/10

Contents: Investigations toward an operational technology in the Arctic basin; The case for further heat budget investigations in the Arctic; Overview of past research on Arctic ocean/atmosphere energy exchange; Overview of past research on mass transport and energy exchange. GRA

N71-23364*# Scientific Translation Service, Santa Barbara, Calif.
LOW-VELOCITY LAYERS WITHIN THE EARTH'S CRUST OF THE UKRAINIAN SHIELD [O SLOYAKH S PONIZHENNYMI SKOROSTYAMI V ZEMNOY KORE UKRAINSKOGO SHCHITA]
N. I. Pavlenkova Washington NASA Mar. 1971 17 p refs Transl. into ENGLISH from Geofiz. Sb., Acad. Nauk Ukr. SSR, Inst. Geofiz (Kiev)
(Contract NASw-2035)
(NASA-TT-F-13536) Avail: NTIS CSCL 08G

A cumulative velocity column has been compiled for the Ukrainian shield, using travel time curves of waves refracted and reflected at the interfaces within the crust. Direct penetrating waves were used to determine velocity functions in the upper part of the cross section; a system of travel-time curves of the waves from the Mohorovici discontinuity has enabled a velocity (averaged for the whole crust) to be determined with great accuracy; reflections from the intermediate crustal boundaries made it possible to calculate layer velocities in the middle portion of the cross section. The velocity column obtained makes it possible to ascertain the nature of the waves recorded as later arrivals and class most of them with reflections. Author

N71-23366*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MAGNETIC STORM EFFECTS IN THE NEUTRAL COMPOSITION
H. G. Mayr and H. Volland Feb. 1971 33 p refs Submitted for publication
(NASA-TM-X-65500; X-621-71-141) Avail: NTIS CSCL 04A

The thermospheric wind circulation, excited during magnetic storms presumably by joule heating within the auroral zone, is shown to be an effective mechanism for removing atomic oxygen at high latitudes. Wind induced variations in O exceed the temperature effects up to 250 km. The calculated deplation is most pronounced at around 180 km where the density can decrease by as much as a factor of two, consistent with the observed storm time variations in the ionosphere. At higher altitudes, this effect is canceled by the thermal expansion in atomic oxygen thus explaining the negligible response in the concentration of this atmospheric constituent under distributed conditions when N2 increased by as much as a factor of ten. Author

N71-23406 Department of Energy, Mines and Resources, Ottawa (Ontario). Earth Physics Branch.
RECORD OF OBSERVATIONS AT AGINCOURT MAGNETIC OBSERVATORY, 1968 AND JANUARY – MARCH 1969
W. R. Darker and D. L. McKeown 1970 70 p *Its* Publ. of the Earth Phys. Branch, Vol. 40, No. 8
Copyright. Avail: Issuing Activity

Tables on the activity of magnetic elements observed in Canada are presented. Data are given for horizontal and vertical

intensities for both quiet and disturbed days. Observations were taken from 1968 and January to March 1969. E.H.W.

N71-23407 Department of Energy, Mines and Resources, Ottawa (Ontario). Earth Physics Branch.
RECORD OF OBSERVATIONS AT FORT CHURCHILL MAGNETIC OBSERVATORY, 1968
G. Jansen van Beek 1970 25 p refs *Its* Publ. of the Earth Physics Branch, Vol. 40, No. 4
Copyright. Avail: Issuing Activity

Data on the geomagnetic field are given in tabular form. Data were taken by continuous photographic recording at the Churchill observatory of Canada. E.H.W.

N71-23408 Department of Energy, Mines and Resources, Ottawa (Ontario). Earth Physics Branch.
RECORD OF OBSERVATIONS AT ALERT MAGNETIC OBSERVATORY, 1968
G. Jansen van Beek 1970 76 p refs *Its* Publ. of the Earth Phys. Branch, Vol. 40, No. 2
Copyright. Avail: Issuing Activity

Data on the parallax, components of the earth's magnetic field, magnetic disturbances, and indicators of amagnetic field conditions are given in tabular form. Observations were made at the Alert Observatory of Canada. E.H.W.

N71-23442*# Translation Consultants, Ltd., Arlington, Va.
ELASTIC PROPERTIES OF METAMORPHIC ROCKS IN THE KRIVOY ROG BASIN [UPRUGIYE SVOYSTVA METAMORFICHESKIKH POROD KRIVOROZHSKOGO BASSEYNA]
A. Dyachkova et al Washington NASA Apr. 1971 27 p refs Transl. into ENGLISH from Geofiz. Sb., Akad. Nauk Ukr. SSR, Inst. Geofiz. (Kiev), no. 17, 1966 p 45-61
(Contract NASw-2038)
(NASA-TT-F-13548) Avail: NTIS CSCL 08G

Investigations made of the elastic properties of metamorphic rocks obtained from deep boreholes in the Krivoy Rog basin are discussed. It is shown that these elastic properties apparently depend on such factors as mineral composition, textural and structural characteristics, nature of the metamorphism that has occurred, and secondary changes. Author

N71-23521# Naval Oceanographic Office, Washington, D.C.
THE ROLE OF THE ARCTIC BASIN IN THE DEVELOPMENT OF THE LAVRASIA STRUCTURE [POL ARKTICHESKOGO BASSEINA V RAZVITII STRUKTURY LAVRAZII]
P. S. Voronov 1971 16 p refs Transl. into ENGLISH from Probl. Arktiki Antarktiki, Sb. Statei (Leningrad), no. 30, 1969 p 10-18
(AD-718068; NOO-TRANS-505) Avail: NTIS CSCL 8/7

A discussion is given of the continential drift theory in its various hypothetical stages. Through the analysis of the existing geological data, it is concluded that two supercontinents, Lavrasia and Gondvana, have existed prior to the middle of the Mesozoic Era. The massifs of the continental crust of Lavrasia consist of old platforms, such as North America, Greenland, Barents Sea, Asia, Russia, Siberia and Kolyma. As a result of the earths rotation, convectional forces of the earths crust and cosmogonic causes, the individual massifs become detached from Lavrasian super-continent and began to drift, forming ridges and deep faults. The geological structure of these formations can be associated with the land masses that had drifted away and constitute now either continents, islands, submarine ridges or trenches. Author (GRA)

N71-23522# Colorado School of Mines, Golden. Dept. of Geophysics.
EVALUATION OF AIRBORNE ELECTROMAGNETIC SURVEYING FOR MAPPING VARIATIONS IN ROCK STRENGTH Final Report, 1 Mar. 1969 - 1 Jul. 1970
George V. Keller, Andre B. Lebel, and Evan L. Ausman, Jr. 1 Dec. 1970 70 p refs
(Contract F19628-69-C-0281)
(AD-718438; AFCRL-70-0701) Avail: NTIS CSCL 8/7

The objective of the report is to determine the feasibility of estimating variations in ground strength on the basis of electrical conductivities measured from the air. A review of the literature indicates that for a wide variety of crystalline igneous rocks, a reasonably unique relationship should exist between resistivity and strength. Three airborne electromagnetic surveying techniques hold promise for measuring ground conductivity in the desired range. These are, in order of the ease with which surveys might be made with existing or modified systems, the wave-tilt method, the long-grounded-wire method and the INPUT method. The wave-tilt method makes use of waves radiated by VLF broadcast stations in the frequency range from 15 to 30 KHz, and is useful with no modification of commercially available equipment, as field tests described in this report indicate. The long-grounded-wire method makes use of fields from a current-carrying cable installed specifically for a survey. The INPUT method makes use of a transmitter carried on the aircraft with the receiver. However, in order to measure conductivities in the range of interest with the existing commercial INPUT system, major modifications would be required. Author (GRA)

N71-23523# Woods-Hole Oceanographic Institution, Mass.
A REPORT ON ATLANTIS 2 CRUISE 22 JUNE, JULY, AND AUGUST 1966. PART 1: THE DYNAMICS OF OCEAN MOVEMENTS IN THE SARGASSO SEA REVEALED BY SOUND VELOCITY AND TEMPERATURE MEASUREMENTS
John C. Beckerle Oct. 1970 155 p refs
(Contracts Nonr-4029(00); Nonr-2866(00))
(AD-718343; WHOI-REF-68-66-Pt-1) Avail: NTIS CSCL 8/10

On Cruise No. 22 of R/V ATLANTIS II from June 10 to August 4, 1966, 115 sound velocity profiles WHOI SVP No. 371 - SVP No. 485, were measured with a sound velocity profiling system that incorporated an on-line PDP-5 computer. The cruise covered approximately 356,000 square miles of water between Bermuda and the Antilles. The main purpose of the cruise was to look for long-period internal Rossby waves expected from earlier cruises, ATLANTIS II No. 11 and CHAIN No. 47, and to improve techniques in gathering oceanographic data. Part I of this report presents the observations of ATLANTIS II Cruise No. 22 with possible interpretations. On the way to the Sargasso Sea ATLANTIS II traversed the eye of hurricane ALMA and new information was obtained on the air-sea interaction. In the Sargasso Sea the temperature data and the sound velocity data suggest that the circulation is complicated with eddies of large size. Part II is separately bound and consists of figures of the sound velocity profiles with comments concerning their reliability where necessary. Author (GRA)

N71-23524# National Science Foundation, Washington, D.C.
THE GEOGRAPHY OF ANTARCTICA [GEOGRAFIYA ANTARKTIDY]
K. K. Markov et al 1970 378 p refs Transl. into ENGLISH from the Russian
(TT-70-50015) Avail: NTIS HC$6.00/MF$0.95 CSCL 08F

Contents: development of geographic theories on Antarctica; the theory of a southern continent; temperate and high latitudes in the Southern Hemisphere; morphometric parameters of Antarctica; rock surface of Antarctica; ice Antarctica (climate and glaciation); periglacial features; geographical zoning of Antarctica; and man in Antarctica. GRA

N71-23540# Naval Oceanographic Office, Washington, D.C.
HORIZONTAL WATER CIRCULATION IN PACIFIC SECTOR OF THE SOUTHERN OCEAN [GORIZONTALNAYA

TSIRKULYATSIYA VOD V TIKHOOKEANSKOM SEKTORE YUZHNOGO OKEANA]
Yu. A. Grigorev 1971 16 p refs Transl. into ENGLISH from Probl. Arktiki Antarktiki, Sb. Statei (Leningrad), no. 30, 1969 p 26–36
(AD-718069; NOO-TRANS-506) Avail: NTIS CSCL 8/3

The Antarctic Circumpolar Current can be clearly distinguished in the complex system of cyclonic and anticyclonic water movements which dominates the Pacific sector of the Southern Ocean. The depth of the current is considerable: at places it can be traced to 3000m. Several branches are formed flowing southward and northward. Three branches are formed on the southern periphery; one flowing southward into the Bellingshausen Sea, the other flowing into the Amundsen Sea and the third flowing into the Ross Sea. Cyclonic water movements are formed in places where these branches join the coastal Antarctic Current. As a result, the water is separated into two parts, one joins the system of cyclonic and anticyclonic circulations while the other part joins the coastal current. Two branches are formed on the northern periphery of the Eastern Circumpolar Current. The largest one flows northward, giving rise to the Peru Current, the smaller one flows toward the Tasman Sea. The maximum velocity of the current varies from 10 to 20cm/sec., reaching 30cm/sec. Author (GRA)

N71-23551# European Space Research Organization, Paris (France).
SUBSTORM EVENTS
J. Ortner and A. F. Moore, eds. Sep. 1969 149 p refs Proc. of ESRO Colloq., Kiruna, Swed., 18–20 Mar. 1969
(ESRO-SP-38) Avail: NTIS

Substorm data are reviewed, and different aspects of measuring substorms are discussed. For individual titles, see N71-23552 through N71-23572.

N71-23552# European Space Research Organization, Paris (France).
THE ESRO PROGRAMME OF AURORAL SUBSTORM INVESTIGATIONS
J. Ortner *In its* Substorm Events Sep. 1969 p 7–8 (See N71-23551 12-13)
Avail: NTIS

The ESRO program of auroral substorm investigations with the ESRO 1, ESRO 2, and HEOS-A satellites is outlined and future projects involving the Azur satellite and the ESRO geostationary satellite are described. ESRO

N71-23553# Alaska Univ., College. Geophysical Inst.
AN OUTLINE FOR FUTURE STUDIES OF MAGNETOSPHERIC SUBSTORMS
Syun-Ichi Akasofu *In* ESRO Substorm Events Sep. 1969 p 11–20 refs (See N71-23551 12-13)
(Grant NSF GA-1661)
Avail: NTIS

Successive magnetospheric substorms are a basic phenomenon during the main phase of magnetospheric storms and they also manifest themselves in auroral, X-ray, ionospheric, proton aurora, and polar magnetic substorms. From the distribution of the magnetic disturbance vectors over the earth's surface a threedimensional electric current system has been deduced. The electric fields which could give rise to such a current system are discussed and their connection with the electron and proton distributions in the magnetosphere is investigated. It is suggested that an outwardly-directed electric field should exist in the evening sector and an inward electric field should exist in the morning sector. The storage and explosive release of energy and its conversion into substorm energy are discussed in detail and further investigation of the asymmetric proton belt is shown to be important. A closely-spaced east-west chain of auroral stations linked to an analysis center is now required for further studies of the auroral electrojet. Author (ESRO)

N71-23554# Kiruna Geophysical Observatory (Sweden).
POLAR MAGNETIC SUBSTORMS
B. Hultqvist *In* ESRO Substorm Events Sep. 1969 p 21–39 refs (See N71-23551 12-13)
Avail: NTIS

IGY and satellite data show that an electric jet current flows westward along the auroral oval rather than along the auroral zone and produces a negative bay close to the auroral oval. Recent satellite measurements support a two-cell current system. DP 1 and DP 2 equivalent current systems are described and discussed. In auroral zone latitudes the currents giving rise to bays flow in the direction of elongated auroral forms but in the polar cap regions the currents flow from 30 to 60 deg away from the auroral arc directions and more experiments are required to resolve this apparent discrepancy. Recently field-aligned currents have been invoked to account for some auroral phenomena and the effect of such currents on magnetosphere models is considered. The dynamics of polar magnetic substorms, including break-up, westward travelling surges, and auroral oval dimensions, are discussed in detail. The role of the southward component of the interplanetary field in DP 1 and DP 2 variations is also considered as well as the magnetic effects in the magnetospheric tail that are associated with polar magnetic substorms. Author (ESRO)

N71-23555# Groupe de Recherches Ionospheriques, Paris (France).
SUBSTORM ASPECTS OF MAGNETIC PULSATIONS
R. Gendrin *In* ESRO Substorm Events Sep. 1969 p 41–43 (See N71-23551 12-13)
Avail: NTIS

Geomagnetic micropulsations can be divided into types which depend on the geometrical size of the magnetosphere and are less sensitive to individual substorms, and types which are very much dependent on the same kind of phenomena at widely separated stations are one of the many investigations of special interest. Further studies over wide areas and correlated with satellite measurements are required. Author (ESRO)

N71-23556# Communications Research Centre, Ottawa (Ontario). Dept. of Communications.
SUBSTORM ASPECTS OF AURORAL ABSORPTION AND OTHER EFFECTS OF THE UPPER PART OF THE AURORAL PARTICLE SPECTRUM
Doris H. Jelly *In* ESRO Substorm Events Sep. 1969 p 45–62 refs (See N71-23551 12-13)
Avail: NTIS

Energetic electrons produce ionization in the from 50 to 100 km region of the atmosphere which absorbs cosmic noise signals, as is shown by riometers. Auroral absorption averages and the average properties of individual substorms, particularly their longitudinal variations, are considered. In addition the poleward and east-west apparent motions of events are analyzed and absorption in all regions is found to be intimately connected. The phenomena known as "spikes' and "islands' are also discussed as well as the location of the absorption during substorms relative to the energetic particle boundaries. Author (ESRO)

N71-23557# Auroral Observatory, Tromso (Norway).
MORPHOLOGY OF THE PULSATING AURORA
G. J. Kvifte and H. Pettersen *In* ESRO Substorm Events Sep. 1969 p 67–70 ref (See N71-23551 12-13)
Avail: NTIS

The morphology of the pulsating aurora made from Tromsoe (67 deg N geomagnetic latitude) during 1967–1968 is studied.

Data obtained from photometric observations are sorted into two groups, one for high and the other for low magnetic activity. ESRO

N71-23558# Royal Inst. of Tech., Stockholm (Sweden).
MAGNETIC MEASUREMENTS
R. Bostroem *In* ESRO Substorm Events Sep. 1969 p 71–72 (See N71-23551 12-13)
Avail: NTIS

Ground-based observations of polar magnetic substorms provide data that are directly related to the dynamics of the magnetosphere during substorm events. Advantages and disadvantages of magnetic recording by means of magnetometers is reviewed. ESRO

N71-23559# Max-Planck-Institut fur Aeronomie, Lindau uber Northeim (West Germany). Inst. fuer Stratosphaerenphysik.
MAGNETIC PULSATION MEASUREMENTS
K. Wilhelm *In* ESRO Substorm Events Sep. 1969 p 73–74 (See N71-23551 12-13)
Avail: NTIS

Certain types of magnetic pulsations are related to, or even form part of, the phenomena constituting a magnetospheric substorm, different means of measuring the magnetic pulsations are suggested. ESRO

N71-23560# Danish Space Research Inst., Lyngby.
VLF EMISSIONS
E. Unstrup *In* ESRO Substorm Events Sep. 1969 p 75–82 refs (See N71-23551 12-13)
AVAIL: NTIS

Methods for measuring the VLF emission during substorm events from satellites and ground stations are reviewed. Future observations are suggested. ESRO

N71-23561# Alaska Univ., College.
ABSORPTION MEASUREMENTS
F. T. Berkey *In* ESRO Substorm Events Sep. 1969 p 83–84 ref (See N71-23551 12-13)
Avail: NTIS

The development of absorption substorms and its implications with respect to auroral absorption measurements at stations widely separated in longitude is considered. ESRO

N71-23562# Arctic and Antarctic Scientific Research Inst. (USSR).
THE DRIFT OF AURORAL IONIZATION
V. M. Driatskiy *In* ESRO Substorm Events Sep. 1969 p 85–88 refs (See N71-23551 12-13)
Avail: NTIS

The longitudinal drift of auroral absorption is dealt with, along the auroral zone and is based on 30 Mc/s riometer records at the three stations Amderma (69 deg 46 N, 61 deg 41 E, L=5.2), Tixie (71 deg 36 N, 128 deg 54 E, L=6.1), and College (64 deg 51 N, 212 deg 06 E, L=5.5), covering the period January 1964 to December 1965. Record processing necessitates the choice of absorption bay and estimations of intensity and the time of commencement of the disturbance. For greater reliability, cases with less than 0.5 dB absorption have been excluded from the analysis. Author (ESRO)

N71-23563# Max-Planck-Institut fur Aeronomie, Lindau uber Northeim (West Germany).
THE DETECTION OF SUBSTORMS
C. Lange-Hesse *In* ESRO Substorm Events Sep. 1969 p 89–95 refs (See N71-23551 12-13)
Avail: NTIS

The VHF beacon transmitters and receiving station network to study VHF continuous wave bistatic aurora backscatter communications are described as well as the VLF phase variation measurements on transpolar propagation paths. ESRO

N71-23564# Bergen Univ. (Norway). Dept. of Physics.
BALLOON MEASUREMENTS OF ELECTRON PRECIPITATION
Harald Trefall *In* ESRO Substorm Events Sep. 1969 p 99–101 refs (See N71-23551 12-13)
Avail: NTIS

Simultaneous measurements by means of balloons launched from stations at different latitudes and longitudes are suggested for studying the morphology and dynamics of auroral zone X-ray events. The investigations of the dynamics of X-ray events are reviewed. ESRO

N71-23565# Liege Univ. (Belgium). Inst. d'Astrophysique.
OPTICAL MEASUREMENTS
A. Monfils *In* ESRO Substorm Events Sep. 1969 p 103–105 (See N71-23551 12-13)
Avail: NTIS

Different techniques for measuring optical emission in the auroras are listed. The preliminary results of S-43 rocket recordings by means of an Ebert-Fastie spectrometer are given. ESRO

N71-23566# Norwegian Defense Research Establishment, Kjeller.
SUBSTORM EFFECTS ON HIGH LATITUDE PARTICLE PRECIPITATION
B. N. Maehlum *In* ESRO Substorm Events Sep. 1969 107–108 (See N71-23551 12-13)
Avail: NTIS

Recent electron and proton precipitation studies can be grouped in four classes: (1) spectral variations of precipitated electrons; (2) electron pitch angular distribution; (3) periodic time variations of electrons; (4) precipitated protons. All four classes are important for the understanding of acceleration processes as well as particle-atmosphere interactions, and their observations are briefly reviewed. ESRO

N71-23567# Royal Inst. of Tech., Stockholm (Sweden).
ELECTRIC FIELD MEASUREMENTS
C.-G. Faelthammar *In* ESRO Substorm Events Sep. 1969 p 109–111 (See N71-23551 12-13)
Avail: NTIS

Knowledge of the electric fields is important for the understanding of many magnetospheric processes such as magnetic substorms. Methods available for electric field measurement at the present time are reviewed and discussed; they include gas release or probes. ESRO

N71-23568# University Coll., London (England). Mullard Space Science Lab.
PLASMA MEASUREMENTS BY LANGMUIR PROBES
A. P. Willmore *In* ESRO Substorm Events Sep. 1969 p 113–114 (See N71-23551 12-13)
Avail: NTIS

High latitude plasma probe measurements in the ionosphere are reviewed. ESRO

N71-23570# Kiruna Geophysical Observatory (Sweden).
PRELIMINARY RESULTS OF ESRO 1 (AURORAE) 1–13 keV ELECTRON AND PROTON MEASUREMENTS
W. Riedler *In* ESRO Substorm Events Sep. 1969 p 118–121 (See N71-23551 12-13)
Avail: NTIS

The results of low-energy auroral particle measurements onboard the ESRO 1 satellite are described and discussed. ESRO

N71-23571# Bergen Univ. (Norway). Dept. of Physics.
FIRST RESULTS FROM THE ESRO 1 S-71 C EXPERIMENT
F. Soeraas *In* ESRO Substorm Events Sep. 1969 p 122–124
(See N71-23551 12-13)
Avail: NTIS

Results of ESRO 1/Aurorae satellite measurements of precipitated and trapped protons in the polar regions are discussed. ESRO

N71-23582# Princeton Univ., N.J. Dept. of Physics.
[RESEARCH IN GRAVITATIONAL THEORY] Final Report, 1 Jul. 1958–30 Jun. 1968
Robert H. Dicke Feb. 1971 9 p refs
(Grant Nonr-1858(30))
(AD-718264) Avail: NTIS CSCL 3/2

The contract was concerned with gravitation and its relation with astrophysics, geophysics and other parts of physics. Highly precise null-experiments were performed, one for the first time, one representing a thousand-fold improvement over previous experiments. The known tests of gravitational theory were reexamined and one has been challenged by the solar oblateness observed by the group. Many of the astrophysical and geophysical implications of gravitational theory have been examined. Author (GRA)

N71-23592# Naval Postgraduate School, Monterey, Calif.
AN ATLAS OF SECCHI DISC TRANSPARENCY MEASUREMENTS AND FOREL-ULE COLOR CODES FOR THE OCEANS OF THE WORLD
Margaret Anne Frederick (M.S. Thesis) Sep. 1970 181 p refs
(AD-718333) Avail: NTIS CSCL 8/10

An investigation was made of the global distribution of Secchi disc water transparency measurements and Forel-Ule water color codes which were on file at the National Oceanographic Data Center prior to June 1969. Charts were constructed for 17 major areas of the worlds oceans to show the horizontal distributions of transparency and/or color. Data generally were presented as mean distributions. Charts were prepared showing the overall mean transparency and Forel-Ule color distribution for all of the data considered, except for the Sea of Japan, for which monthly mean charts were constructed. Plots of transparency measurements against the corresponding color codes were also drawn for five selected areas. Transparency showed marked variations in each area considered. Generally it is greater in the central basins and decreases in coastal regions. Reduced transparency readings and discolored waters were noted for areas affected by river runoff, for areas of high organic productivity, and where standing plankton crops were found. Seasonal variations in transparency and color were not noted except for the Sea of Japan and the Indian Ocean (winter and summer). Author (GRA)

N71-23593# Naval Oceanographic Office, Washington, D.C.
MICROWAVE OBSERVATIONS OF THE OCEAN SURFACE. ANALYSES OF THE NASA/NAVY REVIEW SPACECRAFT OCEANOGRAPHY PROJECT
Dec. 1970 293 p refs Conf. held at Washington, D.C., 11-12 Jun. 1969
(AD-718773; NOO-SP-152) Avail: NTIS CSCL 8/3

For quite sometime oceanographers and meteorologists have been attempting to describe dynamic ocean features as a function of various meteorological parameters. Data used in past studies have been limited by location, instrumentation, and processing. Only recently have remote sensing techniques been applied to determining dynamic ocean features. The results of recent passive and active microwave experiments are presented in the papers contained in this report. Passive microwave (radiometric) observations appear to show that this technique may be capable of determining surface roughness conditions (sea state, spray, percentage of foam and whitecaps, etc.). Active microwave (radar) results appear to show a non-linear relationship of the backscatter cross section as a function of windspeed. Radar data is also being used to describe more fully the high frequency component of the ocean wave spectrum. Author (GRA)

N71-23601# National Physical Lab., New Delhi (India). Radio Propagation Unit.
SOLAR AND GEOPHYSICAL DATA, PART 2, JUNE 1970
Jun. 1970 17 p
(RRC-A-180-Pt-2; SG-53) Avail: NTIS

Predicted and observed solar and geophysical data for June, 1970 are presented in tables and graphs. The data include sunspot numbers, solar flux, solar flares and their effects, magnetic storms, and SID effects. Author

N71-23602# National Physical Lab., New Delhi (India). Radio Propagation Unit.
SOLAR AND GEOPHYSICAL DATA, PART 2, JULY 1970
Jul. 1970 19 p
(RRC-A-181-Pt-2; SG-54) Avail: NTIS

Predicted and observed solar and geophysical data for July, 1970 are presented in tables and graphs. The data include sunspot numbers, solar flux, solar flares and their effects, magnetic storms, and SID effects. Author

N71-23603# National Physical Lab., New Delhi (India). Radio Propagation Unit.
SOLAR AND GEOPHYSICAL DATA, PART 2, SEPTEMBER 1970
Sep. 1970 13 p
(RRC-A-183-Pt-2; SG-56) Avail: NTIS

Predicted and observed solar and geophysical data for September, 1970 are presented in tables and graphs. The data include sunspot numbers, solar flux, solar flares and their effects, magnetic storms, and SID effects. Author

N71-23606# Technische Hogeschool, Delft (Netherlands). Afdeling der Elektrotechniek.
COMPUTATION OF GRAVITY CURRENTS IN ESTUARIES
Cornelis Boudewijn Vreugdenhil (Ph.D. Thesis) Dec. 1970 108 p refs
Avail: NTIS

A mathematical model is derived to describe gravity currents in an estuary, based on salt water and fresh water layers, with and without turbulent mixing. The theory is checked by means of measurements made in the Rotterdam Waterway in 1956. ESRO

N71-23655# New Mexico Inst. of Mining and Technology, Socorro.
ELECTRICAL PROPERTIES OF ICE Final Report, 16 Jul. 1962–31 Oct. 1970
Gerardo Wolfgang Gross Dec. 1970 28 p refs
(Contract Nonr-815(05))
(AD-718359) Avail: NTIS CSCL 8/12

An experimental and phenomenological study was made of the charge separation at the advancing surface of growing ice (Workman-Reynolds effect). The charge separation is fundamentally ascribed to anions and cations of an electrolyte solute crossing the phase boundary at different rates. The sign of the charge on the ice is determined by the preferentially incorporated ion constituent. The magnitude is determined by solute species, solute concentrations, and freezing rate. The process is very sensitive to hydrogen-ion concentration. Solutes widely present in meteoric waters, ammonium, bicarbonate, sodium, and chloride, give rise to large charge separations. Although the present results suggest that water free of impurities will not show appreciable charge separation upon freezing, this question, of paramount importance for an understanding of cloud processes, requires further investigation. Author (GRA)

N71-23656# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
ATMOSPHERIC TRANSPORT PROCESSES. PART 2: CHEMICAL TRACERS
Elmar R. Reiter Oak Ridge, Tenn. AEC Jan. 1971 382 p refs *Its* Atmospheric Sci. Paper No. 133
(Contract AT(11-1)-1340)
(TID-25314) Avail: NTIS HC$6.00/MF$0.95

Work done by various investigators dealing with the distribution of chemical tracers in the atmosphere is reviewed in detail in order to provide information on global transport processes in the atmosphere. The chemical tracers discussed include CO2, O, O3, water vapor, and others. NSA

N71-23657# California Univ., San Diego. Scripps Institution of Oceanography.
ON THE MEASUREMENT OF RADIANT ENERGY FOR CORRELATION WITH PRIMARY PRODUCTIVITY IN THE OCEAN Final Report, 1966–1970
John E. Tyler Dec. 1970 12 p refs
(Contract N00014-69-A-0200-6017)
(AD-718367; SIO-Ref-70-3815) Avail: NTIS CSCL 8/1

It was shown that in the determination of oceanic primary productivity, the related measurements of available radiant energy must be made with appropriate consideration for the spectral and directional properties of the measuring and incubating equipment. Instrumentation for measuring spectral irradiance was modified and used to determine the radiant energy (as well as the total quanta) available for phytoplankton photosynthesis at various depths to 100 meters in the ocean. Simultaneous in situ and simulated-in-situ determinations of the primary productivity were also made. Author (GRA)

N71-23677 Department of Energy, Mines and Resources, Ottawa (Ontario). Earth Physics Branch.
RECORD OF OBSERVATIONS AT BAKER LAKE MAGNETIC OBSERVATORY, 1968
G. Jansen van Beek 1970 76 p refs *Its* Publ. of the Earth Phys. Branch, Vol. 40, No. 3
Copyright. Avail: Issuing Activity

Magnetic observations at Baker Lake, Canada are tabulated for 1968. Tables including mean hourly and daily variometer measurements of north, east, and vertical components; proton precission magnetometer determinations of declination, inclination, and total intensity; summaries of mean hourly values by month, season, and year; and hourly ranges in 10-gamma units for north and east components are presented. J.M.

N71-23688# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INTERACTION OF GEOPHYSICAL PROCESSES IN THE NORTHERN AND SOUTHERN HEMISPHERES IN THE PROBLEM OF TOTAL ATMOSPHERIC CIRCULATION
E. P. Borisenkov 17 Nov. 1970 21 p refs Transl. into ENGLISH from Problemy Arktiki i Antarktiki (USSR), no. 20, 1965 p 11–22
(AD-718477; FTD-HT-23-566-70) Avail: NTIS CSCL 4/2

In this article the author continues to discuss the problem of the interaction of atmospheric processes in the Northern and Southern Hemispheres which he began in connection with research in the area of atmospheric energetics. Data are given on the reserves of kinetic energy of the mean zonal flow in the atmosphere of the Northern and Southern Hemispheres during various seasons. It follows from the data that during the winter in the Northern Hemisphere the reserves of kinetic energy of the mean flow in both hemispheres are approximately the same. During the summer in the Northern Hemisphere there is a maximal contrast between the total reserves of kinetic energy of the zonal flow in the atmosphere of the hemispheres. It is also found that the recurrence of meridional forms of circulation in the Northern Hemisphere has a well pronounced maximum in May as could be expected if it is taken into account that during late fall in the Northern Hemisphere atmospheric processes are more intense than during the winter, and for the Southern Hemisphere April-May should be the period of greatest intensity. Author (GRA)

N71-23687# Chicago Univ., Ill. Illinois Inst. of Tech., Chicago. Lab. for Atmospheric Probing.
THE AMPLITUDE AND ENERGY OF BREAKING KELVIN-HELMHOLTZ WAVES AND TURBULENCE
David Atlas and James I. Metcalf 26 Oct. 1970 36 p refs Prepared in cooperation with Ill. Inst. of Tech.
(Contract N00014-67-A-0285-0007; Grant NSF GA-10639)
(AD-718841; TR-19) Avail: NTIS CSCL 4/1

In this paper a model of Kelvin-Helmholtz waves has been developed which predicts their maximum amplitude, the mode of breaking, and the resulting turbulent kinetic energy. The model is internally consistent and is in reasonable accord with available observations. Author (GRA)

N71-23689# California Univ., San Diego. Inst. of Geophysics and Planetary Physics.
INTERFACE BETWEEN SEA BOTTOM INSTRUMENTS FOR SATELLITES Final Report
Walter Munk and Harold A. Titus 10 Jan. 1971 22 p
(Contract N00014-70-C-0343)
(AD-717986) Avail: NTIS CSCL 8/3

It is desired to determine the location of an emission from multiple observations at long range. Each observation (an angle) will have attached to it, an associated variance. The possibility of apriori information as to location of the emission will be included. A Cartesian coordinate system will be utilized to delineate the estimate of the location of the emission. If no apriori information is known regarding the location of the emission, then the observation set is scanned to find the most reliable and accurate fixes. These are used to obtain a first pseudo apriori location of the emission, and its associated apriori variance. With an initial estimate of the location of the emission, extended Kalman filtering techniques can be utilized. These incorporate the use of perturbations from a nominal estimate in terms of the observation equation. Most processes or events of interest occur randomly in time. Examples of this phenomena are tidal wave (Tsunamis), earthquakes, and underground nuclear tests. Such detectors have some general attributes in common. These include background noise rejection, spurious data (glitches) rejection, signal band enhancement, and squaring or rectifying and integrating over a finite time and comparing with preset thresholds for detection. In addition, these devices should require a minimum of power and size and cost. As an example of such a system, a Tsunami detector is developed in detail. Author (GRA)

N71-23689*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
PLATE TECTONICS IN THE RED SEA REGION AS INFERRED FROM SPACE PHOTOGRAPHY
Dietrich N. Bannert and Ervin Y. Kadar Washington Apr. 1971 17 p refs
(NASA-TN-D-6261; MSC-S-257) Avail: NTIS CSCL 08A

Tectonics of plate sections on land surfaces and associated geologic and morphologic phenomena are inferred from space photography. Tectonic inferences and morphologic manifestations of plate motions on two adjacent regions along the Red Sea (the Israel-Sinai plate section and the Afar region) are discussed. Author

N71-23690# Luftwaffenamt, Porz (West Germany). Inspektion Geophysikalischer Beratungsdienst der Bundeswehr.
RADIOSONDE ASCENTS REACHING HIGH ALTITUDES:

TRIPOLI, LIBYA, 1951–1957. PART 8: SELECTION OF PARTIAL DATA, ATMOSPHERIC PRESSURE [HOCHREICHENDE RADIOSONDENAUFSTIEGE: TRIPOLIS, LIBYEN, 1951–1957. TEIL 8: AUSWAHL VON TEILKOLLEKTIVEN, AUSWAHLPARAMETER: LUFTDRUCK]
W. Alfuth Jul. 1970 41 p In GERMAN
(GeophysBDBw-FM/163-Pt-8) Avail: NTIS

The results of the statistical analysis of partial data collectives on atmospheric density are presented. Tables are arranged by seasons and the data were obtained from radio probing of the upper atmosphere at Tripoli (Libya). ESRO

N71-23691# Luftwaffenamt, Porz (West Germany). Inspektion Geophysikalischer Beratungsdienst der Bundeswehr.
RADIOSONDE ASCENTS REACHING HIGH ALTITUDES: TRIPOLI, LIBYA, 1951–1957. PART 9: SELECTION OF PARTIAL DATA, ATMOSPHERIC TEMPERATURE [HOCHREICHENDE RADIOSONDENAUFSTIEGE: TRIPOLIS, LIBYEN, 1951–1957. TEIL 9: AUSWAHL VON TEILKOLLEKTIVEN, AUSWAHLPARAMETER: LUFTTEMPERATUR]
W. Alfuth Jul. 1970 41 p In GERMAN
(GeophysBDBw-FM/164-Pt-9) Avail: NTIS

The results of the statistical analysis of partial data collectives on atmospheric density are presented. Tables are arranged by seasons and the data were obtained from radio probing of the upper atmosphere at Tripoli (Libya). ESRO

N71-23692# Luftwaffenamt, Porz (West Germany). Inspektion Geophysikalischer Beratungsdienst der Bundeswehr.
RADIOSONDE ASCENTS REACHING HIGH ALTITUDES: TRIPOLI, LIBYA, 1951–1957. PART 10: SELECTION OF PARTIAL DATA, ATMOSPHERIC DENSITY [HOCHREICHENDE RADIOSONDENAUFSTIEGE: TRIPOLIS, LIBYEN, 1951–1957. TEIL 10: AUSWAHL VON TEILKOLLEKTIVEN, AUSWAHLPARAMTER: LUFTDICHTE]
W. Alfuth Jul. 1970 41 p In GERMAN
(GeophysBDBw-FM/165-Pt-10) Avail: NTIS

The results of the statistical analysis of partial data collectives on atmospheric density are presented. Tables are arranged by seasons and the data were obtained from radio probing of the upper atmosphere at Tripoli (Libya). ESRO

N71-23693 Washington Univ., Seattle.
THE RESPONSE OF A STRATIFIED MODEL OCEAN TO A PRESSURE DISTURBANCE MOVING SEA-WARD ACROSS THE CONTINENTAL SHELF
Jerry Alan Galt (Ph.D. Thesis) 1969 105 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 70-8416

A nonlinear, two layer model of the ocean edge is developed. The bottom topography is taken to approximate the continental shelf-continental slope region. The Coriolis parameter is held constant, mixing between layers is assumed negligible and friction is not explicitly included. An infinite ocean offshore boundary condition is approximated by a viscous absorbing layer. The six dependent variables (two velocity components in each layer and the elevation of the free surface and the interface between layers) are integrated using a modified Lax-Wendroff system. The characteristics of the numerical scheme are investigated both theoretically and in a series of numerical test cases. The response of the system is forced by moving pressure disturbance approximating the low pressure region of a storm. Variations in storm speed, layer thickness and stratification are investigated. Dissert. Abstr.

N71-23694*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECTS OF THREE TRANSMISSION MODELS IN THE ROTATIONAL WATER-VAPOR BAND ON RADIANCE CALCULATIONS AND CONSTITUENT INFERENCES
Ruth I. Whitman Washington Apr. 1971 27 p refs
(NASA-TN-D-6112; L-7374) Avail: NTIS CSCL 04A

The effects of the Elsasser, the Bolle-Smith, and the Goody transmission models on the water vapor mixing ratios inferred from horizon radiance profiles measured during the Project Scanner flight (August 1966) over a latitude range from 17 to 58 deg N are presented. The effects of these transmission models on the calculation of radiance and the inference of water vapor mixing ratios in the 315 cm to 475/cm and in the 200/cm to 300/cm rotational water vapor bands are shown. A significant mixing ratio profile shape variation exists when the Bolle-Smith model is used instead of the Elsasser model. This mixing ratio profile variation exists because of the difference in the shape of the two models when the transmission is high; thus, the altitude at which this condition occurs is a function of frequency. It does not appear that the shape of the mixing ratio profile would change significantly as a function of band choice if the Goody tranmission model were used. Coeffieicnts for a temperature correction for the Goody transmission model are presented. By using the Goody model, the mixing ratio for the 315/cm to 475/cm band is essentially independent of altitude above the tropopause over the range of latitudes measured. All three models indicate that below the tropopause over the range of latitudes measured. All three models indicate that below the tropopause, latitude plays a significant role, the highest mixing ratios of these summer measurements occurring at the lower latitudes. Author

N71-23695# National Physical Lab., New Delhi (India). Radio Propagation Unit.
SOLAR AND GEOPHYSICAL DATA, PART 2, AUGUST 1970
Aug. 1970 15 p
(RRC-A-182-Pt-2; SG-55) Avail: NTIS

Data on solar flares and sunspots, as observed by Indian stations, are given in tabular form. The predicted and observed number of sunspots are given. Ionospheric effects on solar flare activity are included. E.H.W.

N71-23696 Princeton Univ., N.J.
A COMPLETELY COVARIANT INTEGRAL THEORY OF INERTIA AND GRAVITATION AND ITS MACHIAN IMPLICATIONS
Robert Campbell Gilman (Ph.D. Thesis) 1969 107 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 70-8364

The development of a Machian theory of inertia and gravitation in which the inertial-gravitational field and its source are considered as just two parts of the physically inseparable source field phenomenon is discussed. This theory is expressed in terms of completely covariant Green's function integral equations based on Einstein's field equations without the cosmological constant term. Integral equations are developed which are formally equivalent to Einstein's field, equations, and the conditions under which these equations are the unique integral equivalents of Einstein's field equations are demonstrated. This integral formulation to define the source-free contribution to the inertial-gravitational field, and build a theory that excludes source free fields. Dissert. Abstr.

N71-23697 Dominion Observatory, Ottawa (Ontario).
RECORD OF OBSERVATIONS AT MEANOOK MAGNETIC OBSERVATORY, 1968
Anne B. Cook and Steven J. Sprysak 1970 54 p refs *Its* Publ. of the Dominion Obs., Vol. 39, No. 12
Copyright. Avail: Issuing Activity

Observations made by the Meanook Observatory on the intensity of magnetic elements are given in tabular form. The equipment used is also discussed. E.H.W.

N71-23731 + Purdue Univ., Lafayette, Ind. Lab. for Agricultural Remote Sensing.
AUTOMATIC IDENTIFICATION AND CLASSIFICATION OF WHEAT BY REMOTE SENSING Research Progress Report
David A. Landgrebe Mar. 1967 7 p *Its* LARS Inform. Note No. 21567
(Rept-279) Avail: NTIS

Early results in the automatic classification of crops from airborne multispectral data are presented for agricultural remote sensing. The specific problem treated is the automatic detection of wheat in late June. Results discussed are contained on the four computer printouts which may be interpreted with the aid of the aerial photograph showing the flight line. Author

N71-23732# Army Natick Labs., Mass. Earth Sciences Lab.
BIBLIOGRAPHY ON ATMOSPHERIC (CYCLIC) SEA-SALTS
William B. Brierly Apr. 1970 79 p refs
(AD-718613; ES-57; TR-70-63-ES) Avail: NTIS CSCL 13/2

The bibliography provides more than 600 references covering all phases of the sea-salt cycle: the origin of the particles in salt lakes, playas, and oceans, the processes by which the salt particles are jetted into the air from sea and lake surfaces by bursting bubbles, their transport inland over the continental landmasses, their impingement, incrustment, and fallout either as dry salt particles or in various forms of precipitation, and their eventual return in rivers to the sea. Selected references are also included on the historic development of the subject, methods of chemical analysis, and techniques of instrumentation and experimental research leading to the formulation of current theories and postulations. An Index to Subjects is included so that the reader may quickly locate references pertaining to his immediate interest. Most of the current meteorological and geophysical journals as well as obscure sources of world-wide scope have been used in this compilation. Author (GRA)

N71-23762# Coast Guard, Washington, D.C. Oceanographic Unit.
OCEANOGRAPHIC OBSERVATIONS BETWEEN ICELAND AND SCOTLAND, JULY-NOVEMBER 1965 Oceanographic Report No. 28
Robert B. Elder Sep. 1970 125 p refs
(CG-373-28) Avail: NTIS

An oceanographic section between Iceland and Scotland was occupied five times between July and November 1965 to study the interchange of water between the North Atlantic Ocean and the Norwegian Sea. Temperature-salinity characteristics were analyzed to determine the proportion of Norwegian Sea Water observed during each occupation. The results indicate that the amount of Norwegian Sea Water increased throughout the period of investigation and that seasonal cooling occurred in the mixed layer. Author

N71-23763# Physics International Co., San Leandro, Calif.
THEORETICAL GROUND MOTION PREDICTIONS SUPPORTING THE HEST PROGRAM
J. Leahy, D. Maxwell, R. Lange, and D. Christensen Dec. 1970 85 p
(Contract DASA01-67-C-0076)
(AD-718388; PIFR-082; DASA-2575) Avail: NTIS CSCL 18/3

The report describes the computations done to predict, design or support the experimental program. MINIDIHEST 1 and 2, and PLANEWAVE 1 are computations done to predict ground motion resulting from relatively simple arrays of alluvium (MINIDIHEST) and layered limestone-shale (PLANEWAVE). PLANEWAVE 2 are computations done to design an experimental explosives array which would produce a plane wave in the ground having a specified intensity and rate of attenuation at a particular range. Another computation predicted the actual ground motion resulting from this experimental array. Merry-Go-Round presents computationally predicted ground motion in Cedar City granite. The parametric studies relate a series of computations which predicted the effect of variation of the explosives array on resulting ground motion as a function of range. Author (GRA)

N71-23773*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A GEOMECHANICAL EVALUATION OF HYDROCARBON CHARACTERISTICS AS CRITERIA FOR THE ABIOGENIC ORIGIN OF NATURALLY OCCURRING ORGANIC MATTER
Katherine Lundstrom Pering (Ph.D. Thesis Stanford Univ.) Mar. 1971 128 p refs
(NASA-TM-X-62020) Avail: NTIS CSCL 08F

Criteria which can be used to distinguish organic matter of abiogenic and biogenic origin was studied. A review of the types of hydrocarbons reported in the literature to be synthesized from simple carbon containing gases suggests that at least four hydrocarbon characteristics have potential as criteria: (1) a complex mixture of predominantly cyclic aliphatic hydrocarbons which yield a hump-like gas chromatographic distribution pattern; (2) a repetitive sequency of monomethyl branched paraffin and olefin isomers in between intense n-alkane peaks, the intensity of all peaks decreasing exponentially with molecular weight; (3) a mixture of two and three ring arenes consisting of even numbers of carbon atoms; and (4) a positive correlation of the C/H ratio of all hydrocarbon types with temperature of formation. This survey suggests that the relative distribution of hydrocarbon types in an abiogenic mixture can provide information about the conditions under which it was synthesized. For instance, the first listed characteristic appears to indicate that methane was the reactant, while the second indicates carbon monoxide. It is concluded that there are subtle differences between altered biogenic and abiogenic aliphatic hydrocarbons. These differences make it possible to use their characteristics as an indicator for the abiogenic origin of organic matter especially if there is no evidence for bacterial activity in the samples. Author

N71-23802# Geological Survey, Washington, D.C.
AEROSPACE METHODS FOR REVEALING AND EVALUATING EARTH'S RESOURCES
William A. Fischer [1971] 16 p refs Presented at the Interreg. Seminar on Photogrammetric Tech., Zurich, Mar. 1971
Avail: Issuing Activity

The role that remote sensors should play in reaching resources and environmental decisions is described, and a synopsis of the rationale followed in the development of the EROS program is given. Remote sensor data are considered as supplementary, used basically for identification of information needs. Repetitive coverage, and an image format suitable for photographic reproduction, and information at regional scales (1:250,000 and smaller) are required. The various spaceborne sensor capabilities for information needs are discussed, and the data collection systems of ERTS-A are used as an illustration. N.E.N.

N71-23808# Rice Univ., Houston, Tex. Dept. of Geology.
DEVELOPMENT OF REMOTE METHODS FOR OBTAINING SOIL INFORMATION AND LOCATION OF CONSTRUCTION MATERIALS USING GAMMA RAY SIGNATURES FOR PROJECT THEMIS Semiannual Report
J. A. S. Adams, H. C. Clark, R. B. Clark, B. G. Cook, and J. S. Duval 15 Dec. 1970 274 p refs
(Contract DACA39-69-C-0048)
(AD-718519) Avail: NTIS CSCL 8/7

A major emphasis in recent years has been the development, calibration, and field testing of airborne gamma-ray spectrometer systems, particularly with the low levels and slow speeds attainable with helicopters. The research described in the following pages is directed toward three main end uses: terrains analysis, including the characterization of soils and rocks on the basis of their thorium, uranium, and potassium contents; trafficability; building materials, e.g.

limestone with optimum clay content for cement; soil moisture; direct exploration for economic deposits of thorium and uranium; indirect mineral exploration for minerals associated with radioactive minerals, e.g. placer gold, or with potassium alteration, e.g. copper; rapid location and assessment of fission product contamination of the environment. Author (GRA)

N71-23836# Woods Hole Oceanographic Institution, Mass.
BIBLIOGRAPHY OF TECHNICAL REPORTS, 1970
Cecelia B. Fuglister, comp. Jan. 1971 17 p refs *Its* Reference No. 70-70
Avail: NTIS

A chronological listing of publications, is presented along with author and contract indexes. N.E.N.

N71-24034 National Lending Library for Science and Technology, Boston Spa (England).
AN ANCIENT EXPLOSION AND ITS SECRET
G. Petrov 24 Jan. 1971 2 p Transl. into ENGLISH from Pravada (Moscow), 17 Nov. 1970
(NLL-M-20262-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The Popigai kettlehole, 250 km from the Arctic Ocean shores in the tundra, was recently investigated by a geological field team. The kettlehole is circular with a 100 km diameter, filled with crushed chunks of rock reminiscent of volcanic rock but also containing foreign minerals and fossil relics. Rivers and streams in the area flow radially. The geologists concluded that many million years ago an asteroid of about 1.5 km across crashed into the earth to a depth of more than a kilometer where it instantly exploded, hurling up vast masses of rock. N.E.N.

N71-24088*# Geological Survey, Washington, D.C.
THE USE OF AIR PHOTO MOSAICS AS SIMULATORS OF SPACECRAFT PHOTOGRAPHY IN LAND USE MAPPING
R. D. Rudd (Oregon State Univ.) and R. M. Highsmith, Jr. (Oregon State Univ.) Jan. 1970 27 p refs
(NASA Order W-12572)
(NASA-CR-106253; PB-194811; USGS-DO-70-008; IR-USGS-194) Avail: NTIS CSCL 08B

The study investigates some of the potential limitations on land use mapping in the Pacific Northwest which may result from the anticipated small scale of future orbital imagery. Since high resolution orbital altitude photography of the area is routinely unavailable, a 1:400,000 photomosaic is used in simulation. Two scales of mapping are carried out and tested: general macro land use and thematic agricultural land use. The only magnification employed was that achieved through the use of a 2x hand lens during the mapping. Substantial mapping potential is indicated despite the small scale of the photomosaic and a mapping classification is proposed. Author (GRA)

N71-24087*# Geological Survey, Washington, D.C.
APPLICATION OF REMOTE SENSING TECHNIQUES TO WATER ORIENTED OUTDOOR RECREATION PLANNING
Robert W. Douglass (Penn. State Univ., Mont Alto) Jan. 1970 21 p refs
(NASA Order W-12572)
(NASA-CR-107636; PB-194810; USGS-DO-70-006; IR-USGS-191; TR-69-2) Avail: NTIS CSCL 08B

The document is concerned with high altitude, small scale photography as a tool for evaluating potential water based recreation sites. Potential recreation sites adjacent to the proposed lake at the Tellico project on the Little Tennessee River were evaluated. Aircraft took photographs at approximately 1:21,300 in October 1968. The images produced were infrared transparencies that were arranged on the roll to prevent stereoscopic interpretation. Success at this scale and flying height indicate merit in continuing with high elevation, small-scale photography. Author (GRA)

N71-24100 National Lending Library for Science and Technology, Boston Spa (England).
THE MYSTERY OF THE POLAR ICE
B. Loginov 16 Feb. 1971 3 p Transl. into ENGLISH from Pravda (Moscow), 5 Aug. 1970
(NLL-M-20304-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The 7-year cyclic motion of the peak of ice formation in the Arctic was investigated and found to result from the nutation of the earth's axis. The 14-month nutation cycle superimposed on the annual deviation results in the 7-year cycle of temperature changes controlling the ice formation. N.E.N.

N71-24167# Environmental Science Services Administration, Boulder, Colo. Earth Sciences Labs.
EARTHQUAKE RESEARCH IN ESSA, 1969–1970
L. R. Alldredge, ed. Jul. 1970 82 p refs
(ESSA-TR-ERL-182-ESL-11) Avail: SOD $0.75

Short reports and abstracts of conference papers are presented on seismic data and theoretical analyses. The topics include specific earthquake data, fault creep, fault monitoring, secular and residual strain measurements, analysis of microseisms, statistical analysis, fault dating, and earthquake mechanisms. N.E.N.

N71-24175 National Lending Library for Science and Technology, Boston Spa (England).
EFFECT OF VOLCANIC ERUPTIONS ON THE TEMPERATURES OF THE ATMOSPHERE
L. R. Rakipova 11 Dec. 1970 7 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 236, 1969 p 25–30
NLL-M-20099-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The absorption of solar radiation by volcanic dust in the upper atmosphere and the resulting effects on the temperature in the troposphere are discussed. Calculations of the temperature decrease in summer and winter due to different size particles are presented, and the inverse influence of temperature on the moisture cycle is considered. The use of such data for estimating the climate of the geological past caused by paleovocanic activity is also mentioned. N.E.N.

N71-24176# National Physical Lab., New Delhi (India).
SOLAR AND GEOPHYSICAL DATA, PART 2
Oct. 1970 10 p
(RRC-A184-Pt-2; SG-57) Avail: NTIS

Predicted and observed solar and geophysical data for September 1970 are presented in tables. The data include sunspot numbers, solar flux, solar flares and their effects, magnetic storms, and SID effects. Author

N71-24177# Environmental Science Services Administration, Boulder, Colo. Earth Sciences Labs.
AN INTRODUCTION TO GEOMAGNETIC INSTRUMENTS AND OBSERVING
W. H. Campbell Sep. 1970 44 p refs
(ESSA-TR-ERL-183-ESL-12) Avail: SOD $0.50

Systems and techniques for observations of the magnetism of the earth in space are described. The necessary physical concepts employed for currently used magnetometers are reviewed. A discussion of observatory site selection and some general information regarding measurements above the earth's surface are included. Author

N71-24196# Raven Industries, Inc., Sioux Falls, S. Dak.
SKYHOOK CHURCHILL 1970 Final Report
Charles H. Cravaack and Thomas Pappas 28 Dec. 1970 195 p
(Contract N00014-70-C-0231)
(AD-718371; R-1270032) Avail: NTIS CSCL 4/1

The program was funded for a period of forty-five days in the field at Fort Churchill, Manitoba. Raven provided a field crew, suspension and rigging hardware, aircraft and helicopter tracking as well as gondola recovery, parachutes, balloon telemetry and control instrumentation, down-range tracking station, and reports and documentation as necessary. Of the nineteen balloons used, sixteen were successful flights. The report describes individual flights, equipment used, flight data, and various program summary information. Author (GRA)

N71-24230 National Lending Library for Science and Technology, Boston Spa (England).
MANIFESTATION OF SOLAR ACTIVITY IN RIVER RUNOFF AND LEVELS OF LAKES IN EUROPE
V. F. Loginov [1971] 13 p refs Transl. into ENGLISH from Tr. Arkt. Antarkt. Nauchn.-Issled. Inst. (Leningrad), no. 289, 1969 p 104–115
(NLL-M-20097-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The frequency structure of the hydrological characteristics in different regions of Europe at different periods of time was investigated. Observations of river run-off and lake level were subjected to a frequency analysis by the Schuster method in periods of 2 to 25 years. A comparison was made between the index of geomagnetic disturbance and the meridional circulation during the years 1923 to 1953. The following conclusions are made: The frequency distributions of the climatic characteristics and of solar activity are similar. The spatial distribution of the cycles in the atmosphere and hydrosphere cannot be explained without the study of external factors. The secular cycle phase of solar activity exerts an important influence on the character of sun-troposphere relationships; the character can be explained if one of the possible agents acting on the atmospheric circulation is high energy particles. In superlong range forecasting of hydrometeorological elements, the secular and 11-year cycles of solar activity should be taken into account. Author

N71-24246# Laboratoire d'Aerothermique Du C.N.R.S., Bellevue (France).
FROST INSTITUTE AT CAEN: FIRST EXPERIMENTAL RESULTS [LA STATION DE GEL DE CAEN: PRESENTATION, PREMIERE EXPERIMENTATION]
A. Philippe (Lab. Central des Ponts et Chaussees), J. Aguirre-Puente, and H. Bertouille (CER, Rouen, France) Sep. 1970 71 p refs In FRENCH
(Publ-387) Avail: NTIS

The construction of a facility for studying frost and thawing effects on structures that generally rest on frozen foundations is reported. A description of the new facility is provided and obtained experimental results on frost penetration are given. It is found that: (1) linear frost depth is a function of the square root of the frost index with change in gradient corresponding to soil foundation intersurface; (2) some evidence is produced that a linear relationship exists between the square root of the frost index at the earth surface and the surface of the substructure, respectively; and (3) defrosting propagates similar to freezing in analog soil sections. Transl. by G.G.

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N71-23116*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DYNAMIC AND STATIC WIND TUNNEL TESTS OF A FLOW DIRECTION VANE
Norman R. Richardson Washington Apr. 1971 22 p refs
(NASA-TN-D-6193; L-7431) Avail: NTIS CSCL 14B

Dynamic and static wind tunnel tests of a low-inertia flow-direction vane are described. The vane was designed to provide good dynamic response characteristics and was used for the in-flight measurement of gust velocities. Both subsonic and supersonic tests were conducted. The data indicated that the natural frequency of the vane is about one-half times the square root of the dynamic pressure (measured in N/sq m) or about three times the square root of the dynamic pressure (measured in psf). The data also indicated that the damping ratio is between 0.80 and 0.65 critical at sea level and varies approximately as the square root of the air density. Author

N71-23149# Environmental Science Services Administration, Rockville, Md. Geodetic Research and Development Lab.
AN ADVANTAGEOUS, ALTERNATIVE PARAMETERIZATION OF ROTATIONS FOR ANALYTICAL PHOTOGRAMMETRY
Allen J. Pope Sep. 1970 21 p refs Presented at the 1970 Symp. on Computational Photogrammetry of the Am. Soc. of Photogrammetry, Alexandria, Va., 7–9 Jan. 1970
(ESSA-TR-C/GS-39) Avail: SOD $0.30

An orthogonal matrix was used in analytical photogrammetric solutions. Derivation and interpretation of the basic formulas and various auxiliary formulas, differential form development for the parameterization, formula choice for photogrammetry applications, formulas for inverse and direct transformation from parameters to other parameterizations, and a small numerical example are discussed. J.A.M.

N71-23150# Argonne National Lab., Ill.
SODIUM TECHNOLOGY Quarterly Report, Jul.–Sep. 1970
G. M. Kesser, comp. Dec. 1970 67 p refs
(Contract W-31-109-eng-38)
(ANL/ST-4) Avail: NTIS

A national meter program was implemented to characterize instrumentation for on-line monitoring of oxygen, carbon, and hydrogen impurities in sodium and for detecting leaks in steam generators, and to establish commercial availability of the on-line meters, which will be built to RDT standards. In the analytical standards program, the management effort continued, with the goal of formulating standard analytical and sampling methods to be uniformly applied throughout the national sodium technology program; development work proceeded on methods for determining oxygen, carbon, nitrogen, and trace metals in sodium. Work continued on the definition of radioactivity problems associated with the repair and maintenance of LMFBRs, the development of methods for detecting and characterizing fuel failures, and the evaluation of problems created by sodium aerosol in cover gas. Author (NSA)

N71-23151# Oak Ridge National Lab., Tenn. Analytical Chemistry Div.
ANALYTICAL MASS SPECTROMETRY AT OAK RIDGE NATIONAL LABORATORY
A. E. Cameron, W. H. Christie, H. S. McKown, W. T. Rainey, Jr., and D. H. Smith Jan. 1971 67 p refs
(Contract W-7405-eng-26)
(ORNL-4643) Avail: NTIS

These spectrometers, as well as the electronic equipment and computer programs associated with their use, are described. These instruments include those of two and three stages used primarily for the isotopic analysis of heavy metals and those of high

and low resolution used for the analysis of organic compounds. Techniques and equipment used for accumulation of data are discussed. Author (NSA)

N71-23152# California Univ., Livermore. Lawrence Radiation Lab.
WEAPONS EFFECTS DISPLAY SYSTEM (WEDS MOD 2): MAINTENANCE MANUAL, VOLUME 4, PART 2: PROMPT EFFECTS SYSTEM
R. A. Goodman and D. J. Peschel Sep. 1970 185 p Sponsored by AEC
(UCRL-50892-Vol-4-Pt-2) Avail: NTIS

The prompt effects portion of the weapons effects display system is described, together with procedures for checking out the data interface and for isolating faulty components. Detailed maintenance and troubleshooting information is presented in appendices. Author (NSA)

N71-23153# California Univ., Livermore. Lawrence Radiation Lab.
WEAPONS EFFECTS DISPLAY SYSTEM (WEDS MOD 2): MAINTENANCE MANUAL, VOLUME 4, PART 1: FALLOUT DISPLAY SYSTEM
J. H. Cooper, D. J. Peschel, and L. O. Fagen, ed. Nov. 1970 79 p refs Sponsored by NASA
(UCRL-50892-Vol-4-Pt-1) Avail: NTIS

The fallout display portion of the weapons effects display system is described. The fallout display system computes radioactive fallout based on console-entered weapons parameters and meteorological data. Resultant patterns are displayed as an overlay on a projected map. Author (NSA)

N71-23174* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SIDEREAL FREQUENCY GENERATOR Patent
Paul F. McCaul and Raymond L. Granata, inventors (to NASA) Issued 17 Dec. 1968 (Filed 28 Sep. 1965) 4 p Cl. 321-60
(NASA-Case-XGS-02610; US-Patent-3,417,316; US-Patent-Appl-SN-491054) Avail: US Patent Office CSCL 14B

A system is described for generating sidereal frequency signals from signals of standard solar frequency without the use of mixing operations or feedback loops. The system utilizes only multiplying and dividing means arranged in a serial manner. This produces a fail-safe operation, so that a malfunction or failure at any point along the seristim chain will cause the output to fail. Further, the difficulty of checkout and repair of the hardware involved is greatly reduced. Detailed descriptions accompany drawings of the apparatus. E.M.C.

N71-23178* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
OPTICAL MONITOR PANEL Patent
Francis D. Griffin, inventor (to NASA) Issued 3 Dec. 1968 (Filed 19 Jul. 1966) 5 p Cl. 356-166
(NASA-Case-XKS-03509; US-Patent-3,414,358; US-Patent-Appl-SN-566392) Avail: US Patent Office CSCL 14B

A panel consisting of a translucent screen with test or meter information being projected onto it from the rear is described. With the exception of command switches at the bottom of the panel, the entire panel information is a compilation of light projections. One master projector projects all of the panel nomenclature such as titles, subtitles, division lines, and component identifications. Smaller individual projectors provide panel viewing of analog and discrete functions. Official Gazette of the U.S. Patent Office

N71-23217# National Oceanographic Instrumentation Center, Washington, D.C.
MODEL 333A-5 PRECISION BATHYMETRIC RECORDER, EDO WESTERN CORPORATION, SALT LAKE CITY, UTAH 84115 Instrument Fact Sheet
Mar. 1971 8 p refs
(IFS-71010) Avail: Issuing Activity

The Edo Western model 333A-5 percision bathymetric recorder is an all-solid-state electromechanical instrument used primarily in oceanography for obtaining ocean bottom profiles (or water depths in general). Echoes from the transmitted sound burst are processed in the shipboard transceiver, amplified, and read out on a chart recorder to provide an integrated profile of the ocean bottom. The chart paper is the dry electrosensitive type, 19.125 inches in width and 200 feet in length (61 meters). The unit is available in four types with ranges of 0 - 100, 0 - 400, 0 - 1000, or 0 - 4000 fathoms. The instrument evaluated was that with the 4000-fathom depth capability with eight switch-selectable depth scales: 100, 200, 400, 500, 800, 1000, 2000, and 4000 fathoms. Author

N71-23225* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
IMPACT TESTING MACHINE Patent
Carl Edward Johnson, inventor (to NASA) Issued 26 Nov. 1968 (Filed 23 Dec. 1965) 3 p Cl. 73-12 Sponsored by NASA
(NASA-Case-XNP-04817; US-Patent-3,412,598; US-Patent-Appl-SN-516152) Avail: US Patent Office CSCL 14B

The device consists of a track along which the package to be tested is guided, with a pair of bow limbs on either side of the track to which is attached a bow line. A carriage in which the package is carried, is attached to the bow line. A source of power, such as an electrical winch, draws the bow line against the bias of the bow limbs. A quick release mechanism, when actuated releases the power source from the bow line so that the carriage is propelled toward an impact receiving surface. The package is hurled at high velocity against the impact receiving surface. Official Gazette of the U.S. Patent Office

N71-23226* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ZETA POTENTIAL FLOWMETER Patent
Billy G. Moser and Raymond E. Wiech, inventors (to NASA) Issued 19 Nov. 1968 (Filed 3 Aug. 1966) 4 p Cl. 73-194 Sponsored by NASA
(NASA-Case-XNP-06509; US-Patent-3,411,356; US-Patent-Appl-SN-570095) Avail: US Patent Office CSCL 14B

A flowmeter is described which consists of a tubular chamber, disposed in the direction of flow of a fluid. At least 60% of the chamber volume is filled with nonporous glass beads. Electrodes with electrically conductive meshes, through which fluid flows into and out of the chamber, are positioned at opposite ends of the chamber. The rate of flow of fluid through the chamber is determined by measuring the Zeta potential difference between the electrodes. Official Gazette of the U.S. Patent Office

N71-23227* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ZERO GRAVITY APPARATUS Patent
James F. Chumley and Guy D. Perry, inventors (to NASA) Issued 5 Nov. 1968 (Filed 9 May 1966) 5 p Cl. 73-432
(NASA-Case-XMF-06515; US-Patent-3,408,870; US-Patent-Appl-SN-548808) Avail: US Patent Office CSCL 14B

A zero gravity device that includes a drop tower and a vertical deceleration tube having a pair of guide rails extending the length of the device, is described. A capsule is slidably mounted on the guide rails and the capsule is dropped from the top of the drop tower into the deceleration tube and its acceleration is controlled during descent so as to provide a short period of zero gravity. A plurality of spaced annular seals are positioned in the deceleration tube. These seals engage the outer periphery of the dropped capsule and result in a pressure buildup within the deceleration tube that decelerates and stops the capsule. A series

of vent orifices in the side of the deceleration tube exhausts pressure built up within the tube so as to prevent rebounding of the capsule. Official Gazette of the U.S. Patent Office

N71-23240* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

MICROMETEOROID PENETRATION MEASURING DEVICE Patent

William H. Kinard, James H. Siviter, Jr., and Charles C. Laney, Jr., inventors (to NASA) Issued 22 Oct. 1968 (Filed 19 Nov. 1965) 4 p Cl. 250-227
(NASA-Case-XLA-00491; US-Patent-3,407,304; US-Patent-Appl-SN-508873) Avail: US Patent Office CSCL 14B

A device is described for measuring the micrometeoroid depth of penetration into various structural materials such as metals, ceramics, and plastics when they are exposed to a space environment. Several layers of optical fibers are embedded in a material at various depths to detect the penetration of impacting micrometeoroids. F.O.S.

N71-23250*# Honeywell, Inc., Minneapolis, Minn. Systems and Research Div.

HIGH TOTAL TEMPERATURE SENSING PROBE FOR THE X-15 HYPERSONIC AIRCRAFT

Ronald G. Bailey Sep. 1968 85 p refs
(Contract NAS4-1211)
(NASA-CR-116772; Rept-12080-FRI) Avail: NTIS CSCL 01D

The results are presented of research aimed at applying the fluid oscillator concept to the development of a probe for measuring free stream total temperatures on hypersonic aircraft of the X-15 class. The probe generates an oscillating pressure signal in the form of a sonic pressure wave which is propagated and reflected within the device to cause an oscillation of the incoming fluid. The sensor oscillation frequency is dependent on the acoustical velocity of the wave within the fluid, and thus a function of the fluid temperature in the probe cavity. The probe utilizes a cooled sensor concept in which the probe body temperature is maintained below the material melting point with nitrogen gas coolant. The free-stream total temperature is arrived at through measurements of the oscillation frequency, body temperature and local pitot pressure. The frequency is measured with two conventional pressure transducers arranged to operate in push-pull, with either transducer capable of independent operation should the other fail. The time response of the instrument is dependent upon the purging time of the fluid within the sensor cavities which is about 10 milliseconds. Author

N71-23283# National Oceanographic Instrumentation Center, Washington, D.C.

MODEL 200 ACOUSTIC COMMAND SYSTEM, AMERICA MACHINE AND FOUNDRY COMPANY, ALEXANDRIA DIVISION, ALEXANDRIA, VIRGINIA 22314 Instrument Fact Sheet

Mar. 1971 11 p
(IFS-71009) Avail: Issuing Activity

The acoustic command system model 200 designed for remote control and monitoring applications in oceanographic environments to depths of 20,000 ft is described. The system consists of a shipboard command unit and an acoustically operated underwater release device. A timer module is incorporated to provide an alternative for activating the anchor release system. Transducers for detection of amplitude modulated, double sideband signal are also examined. The precautions taken against false signals are briefly reviewed. J.A.M.

N71-23287* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

INDUCTION FURNACE WITH PERFORATED TUNGSTEN FOIL SHIELDING Patent

Henry J. Geringer, inventor (to NASA) Issued 30 Sep. 1969 (Filed 16 Feb. 1967) 4 p Cl. 13-26; Int. Cl. H05b5/16
(NASA-Case-XLE-04026; US-Patent-3,470,304; US-Patent-Appl-SN-617770) Avail: US Patent Office CSCL 14B

An induction heater having tungsten foil shielding between its coil and the specimen which is to be heated is described. The foil is perforated to minimize susceptior, and it is loosely wound into a tubular configuration about the susceptor or specimen. Official Gazette of the U.S. Patent Office

N71-23288* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

COMBINED OPTICAL ATTITUDE AND ALTITUDE INDICATING INSTRUMENT Patent

Arthur W. Vogeley and Alfred J. Meintel, Jr., inventors (to NASA) Issued 31 Dec. 1968 (Filed 2 Jan. 1964) 7 p Cl. 356-72
(NASA-Case-XLA-01907; US-Patent-3,419,329; US-Patent-Appl-SN-335441) Avail: US Patent Office CSCL 14B

Optical instrumentation to facilitate take off and landing of aircraft or space vehicles on planetary surfaces is described. The system serves as a primary or backup onboard instrumentation system to present vehicle altitude and attitude information on a screen located on the vehicle instrument panel and viewable by the pilot or other occupants of the vehicle. Official Gazette of the U.S. Patent Office

N71-23289* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

SOLAR SENSOR HAVING COARSE AND FINE SENSING WITH MATCHED PREIRRADIATED CELLS AND METHOD OF SELECTING CELLS Patent

Anthony Fontana, inventor (to NASA) Issued 18 Jun. 1968 (Filed 8 Dec. 1964) 10 p Cl. 250-203
(NASA-Case-XLA-01584; US-Patent-3,389,260; US-Patent-Appl-SN-416943) Avail: US Patent Office CSCL 14B

A solar sensor having geometrically opposed coarse and fine sensing elements is described. The elements are located on the pitch and yaw axes and arranged to provide full spherical field of view. Certain of the elements are preirradiated and then matched according to their degradation rates. The sensor has no moving parts thus being particularly adapted for the space environments. Official Gazette of the U.S. Patent Office

N71-23347# National Science Foundation, Washington, D.C.

THE ASPIRATION METHOD FOR THE DETERMINATION OF ATMOSPHERIC ION SPECTRA [ASPIRATSIONNYI METOD IZMERENIYA SPEKTRA AEROIONOV]

H. F. Tammet 1970 207 p refs Transl. into ENGLISH from Uch Zap. Tartusk. Gos. Univ. (Tartu), v. 2, no. 195, 1967 232 p
(TT-68-50499) Avail: NTIS CSCL 14B

The requirements imposed on the measuring capacitor are rendered more stringent, possibilities of measuring integral quantities with the aid of differential counters are indicated and new variants of the method of modulating the air-ion current in the measuring capacitor are suggested. The systematic measurement errors are investigated and the range of application of the aspiration method determined. Empirical relationships are developed which suffice for the quantitative estimation of the essentially nonlinear edge effect. The distorting effects caused by an increase in the air-ion concentration, the asymmetry of the measuring capacitor, and the mass of air ions are calculated. A theory is developed for the resolving power of the counter which is limited by diffusion and turbulence. A survey is given of the different designs of the aspiration counter along with a description of the SAI-TGU-66 universal aspiration counter. Author (GRA)

N71-23369*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN AUTOMATIC UNDERWATER CAMERA SYSTEM
Russell J. Jirberg [1971] 12 p Presented at the 14th Great Lakes Res. Conf., Toronto, 19–21 Apr. 1971; sponsored by Univ. of Toronto Intern. Assoc. for Great Lakes Res.
(NASA-TM-X-67807) Avail: NTIS CSCL 14E

A special purpose automatic underwater camera system was designed and operated during the summer of 1970 to obtain a time-lapse photographic record of the algae growth and sedimentation at the bottom of mid-Lake Erie. The system was built around a conventional 35 mm camera and electronic flash unit. Automatic control circuitry enabled it to operate unattended at the bottom of the lake for extended periods of time. Details of the system's design and operational characteristics are presented. Author

N71-23370# National Oceanographic Instrumentation Center, Washington, D.C.
MODEL A850 MAGNETIC TAPE RECORDING CURRENT METER, GEODYNNE CORPORATION, WALTHAM, MASSACHUSETTS 02154 Instrument Fact Sheet
Mar. 1971 6 p refs
(IFS-71011) Avail: Issuing Activity

The Geodyne model A850 magnetic tape recording current meter designed to measure water current speed in the range between 0.05 and 7 knots and current direction to subsurface levels equivalent to 8000 psi is discussed. The measurements are recorded in serial binary form on a self-contained, closed-loop magnetic tape. The current meter employs a Savonius type rotor for speed sensing, with 16 small magnets mounted on the upper surface to actuate a reed switch. Switch closures are counted over a 5-second sample period by means of solid-state digital circuitry. Dual-channel one-quarter inch tape is used. Current direction is sensed with a directional vane housed in a protective framework beneath the current-meter pressure housing. The vane is magnetically coupled through the bottom of the pressure case so that its motion is followed by a pivoted gray-code disc. An additional gray-code disc is attached to a gimbaled compass. Light-conducting, fiber optic pipes and photocells convert these gray-code disc orientations into an electrical binary code which is recorded on the magnetic tape. Later computation provides current direction with respect to magnetic north. A timer controls recording sequences, or modes, and is manually switchable inside the pressure housing. Each recording sequence provides a specific number of samples at 5-second intervals per sampling cycle. Author

N71-23375# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
STEREOSCOPES
8 Jan. 1971 18 p
(AD-718790; MTP-10-3) Avail: NTIS CSCL 14/5

The Materiel Test Procedure describes the procedures to be used in evaluating stereoscopes: Preparation for test; Operator training and familiarization; Safety hazards; Pre-operational inspection and physical characteristics; Functional suitability; Human factors engineering; Maintenance evaluation; and Reliability. Author (GRA)

N71-23401*# Westinghouse Electric Corp., Pittsburgh, Pa.
EXTENDED AREA SEMICONDUCTOR RADIATION DETECTORS AND A NOVEL READOUT ARRANGEMENT Patent
Karl Reinitz, inventor (to NASA) Issued 10 Dec. 1968 (Filed 28 Dec. 1965) 6 p Cl. 250-83 Sponsored by NASA
(NASA-Case-XGS-03230; US-Patent-3,419,992; US-Patent-Appl-SN-517158) Avail: US Patent Office CSCL 14B

A mossic particle sensor having increased sensitivity including means for obtaining higher accuracy position readout with improved ruggedness and reliability is described. The sensor is comprised of a composite surface barrier diode having a matrix on its insensitive side formed by overlapping elongated contacts. Thus, if a signal is detected on a particular row or column of the matrix, the position of the particle can be conveniently determined to a degree of accuracy depending on the line density of the contacts. Official Gazette of the U.S. Patent Office

N71-23409 Department of Energy, Mines and Resources, Ottawa (Ontario). Earth Physics Branch.
BIBLIOGRAPHY OF FLUXGATE MAGNETOMETERS
F. Primdahl 1970 16 p refs *Its* Publ. of the Earth Phys. Branch, Vol. 41, No. 1
Copyright. Avail: Issuing Activity

The following bibliography lists papers on fluxgate magnetometers and closely related devices, by the name of the first author in the order of the English alphabet. Most of the references include a short description of the contents under the following headings: (1) type of sensor, (2) theoretical calculations, (3) experimental data, and (4) instrument design and description. Author

N71-23476# European Space Research and Technology Center, Noordwijk (Netherlands).
THE ESRO-1 ATTITUDE MEASUREMENT SYSTEM
C. C. Kalweit Paris ESRO Oct. 1969 98 p refs
(ESRO-TN-99-ESTEC) Avail: NTIS

The ESRO-1 attitude measurement system (AMS) is made up of four magnetic aspect sensors, using a modified fluxgate principle, and 5 x 2 digital solar aspect sensors. The philosophy that led to the system design is described paying particular attention to the problem of magnetic interference. The hardware, which has several novel features, is described in detail. The attitude measurement instruments developed for this project strive to combine low power consumption and weight with high accuracy and reliability. The methods used for testing and calibrating the system are described and an error analysis based on the ground test results is presented. Author (ESRO)

N71-23623# Purdue Research Foundation, Lafayette, Ind.
STUDY OF POTENTIAL APPLICATION OF HOLOGRAPHIC TECHNIQUES TO MAPPING Interim Technical Report, Sep. 1969 – Sep. 1970
Gary H. Glaser and Edward M. Mikhail Dec. 1970 210 p refs
(Contract DAAK02-69-C-0563)
(AD-718084; ETL-CR-70-8) Avail: NTIS CSCL 8/2

The report is primarily concerned with the precision and pointing at a holographically produced image. After consideration of several possibilities, measurements performed by placing a small self-illuminated dot within the space of the virtual image from the hologram proved to be most feasible. It is shown that images from holograms can be measured by use of a floating dot in a manner similar to that used in mensuration of photogrammetric stereomodels. Simulation studies were performed and indicated that shifts in the reconstruction beam angle of up to 5 degrees could be tolerated. A shift of larger than 5 degrees caused large distortions in the image geometry which could not be removed by a linear transformation. The investigation is in three parts; concise discussion of the properties of holography and photogrammetry; theoretical imaging characteristics; and mensuration. Author (GRA)

N71-23626# National Bureau of Standards, Washington, D.C.
INNOVATING METROLOGY: KEY TO PROGRESS. PROCEEDINGS OF THE 1970 STANDARD LABORATORY CONFERENCE
H. L. Mason, ed. Mar. 1971 128 p refs Conf. held at Gaithersburg, Md., 15–17 Jun. 1970
(NBS-SP-335) Avail: SOD $1.50

Technical papers are presented on new technologies and applications, laboratory management and operations, methods of optimizing calibration intervals, new ways of managing, and international developments. For individual titles, see N71-23627 through N71-23650.

N71-23627# National Bureau of Standards, Washington, D.C.
MEASUREMENT IN A CHANGING WORLD: KEYNOTE ADDRESS
Lewis M. Branscomb *In its* Innovative Metrology: Key to Progr. Mar. 1971 p 3–8 (See N71-23626 12-14)
Avail: SOD $1.50

The direction of emphasis in metrology in the near future is discussed. The responsibilities of the NBS are identified as (1) establishing the central basis for physical measurements in the United States, (2) working down the measurement chain from fundamental quantities to those of practical measurements, (3) transferring into the secondary laboratories the basic measurement capability generated at NBS, and (4) assuring adequate verification that the transfer of measurement capability is sufficiently effective for the user's requirement. Examples of the first and last responsibilities are discussed, and the underlying theory of measurement and relevancy to the actual end use are stressed. N.E.N.

N71-23628# Commerce Dept., Washington, D.C.
INNOVATION IN MEASUREMENT
Myron Tribus *In* NBS Innovative Metrology: Key to Progr. Mar. 1971 p 9–10 (See N71-23626 12-14)
Avail: SOD $1.50

Responsibilities and management decisions of a progressive standards laboratory are described. It is felt that a first-rate laboratory must be able to give a customer an unambiguous statement of what the laboratory does for him, and to meet the requirements both of utmost accuracy in calibration and also of lesser accuracy with greater speed in operation. An understanding of the tradeoffs between cost and accuracy, between cost and turnaround time, and of the customer is essential. The role played by the Measurement Analysis Program in advanced calibration techniques is discussed. N.E.N.

N71-23629# Avco Lycoming Div., Stratford, Conn.
THE EVOLUTION OF A RADIOLOGICAL MENSURATION TECHNIQUE
Herbert Bardach and Stanley Wisnieff *In* NBS Innovative Metrology: Key to Progr. Mar. 1971 p 11–22 refs (See N71-23626 12-14)
Avail: SOD $1.50

A radiological mensuration technique was devised to measure the minimum wall thickness anchoring from interior corner points of small castings invested with internal cavities. The factors involved in the development of the mensuration technique which culminated in the manufacture of a semi-automatic machine tooled with a strontium 90 gage were examined in detail. These factors included the phenomenology of beta transmission through plural media, the subtleties of counting geometry, and the characteristics of the beta spectrum, all of which contributed in some measure to the efficacy and uniqueness of the beta emitter as a mensuration tool. The technique involved the positioning of an encapsulated strontium 90 point source contiguous with the interior points at which the minimum wall thicknesses were to be measured and determining these thicknesses by referencing the observed beta transmission counting rates to a calibration curve. Author

N71-23630# Edgerton, Germeshausen and Grier, Inc., Goleta, Calif.
AN AUTOMATED TIME DOMAIN INSTRUMENT TEST CONSOLE
L. S. Kreyer *In* NBS Innovative Metrology: Key to Progr. Mar. 1971 p 23–28 (See N71-23626 12-14)
Avail: SOD $1.50

A computer-controlled system which automatically tests the performance of oscilloscopes and other time domain instruments is described. The system utilizes advances in pulse technology to speed up the calibration process by replacing frequency domain test methods with time domain test methods. Cost effectiveness of this system in terms of reduced man hours to calibrate an instrument, reduction of systematic errors due to operator bias, and consistent reporting of test results are described. Author

N71-23632# Weinschel Engineering Co., Inc., Gaithersburg, Md.
COST REDUCTION IN CALIBRATING BOLOMETER MOUNTS
William F. Dentinger and Louis de Pian *In* NBS Innovative Metrology: Key to Progr. Mar. 1971 p 35–38 ref (See N71-23626 12-14)
Avail: SOD $1.50

An automated system which cuts RF power measurement time from about 30 to about 3 minutes is described. The bolometer element is placed in a Wheatstone bridge circuit. The method provides about 30 mW of dc power to the standard bolometer mount, decreases the substituted power by fixed amounts from 0.5 to 10 mW over the frequency range 100 MHz to 12.4 GHz for coaxial systems and 2.6 to 12.4 GHz for waveguide systems, and forces the power supplied to the bolometer mount to be equal to the substituted power. N.E.N.

N71-23637# Autonetics, Anaheim, Calif.
KEYS TO OPTIMUM CALIBRATION INTERVALS
Rolf B. F. Schumacher *In* NBS Innovative Metrology: Key to Progr. Mar. 1971 p 57–64 refs (See N71-23626 12-14)
Avail: SOD $1.50

The main sources of ignorance about instrument behavior and about the influence of a calibration control system on instrument behavior and on evaluation of this behavior are described. Seven keys to the establishment of an efficient method for calibration interval adjustment are outlined. Emphasis is on efficiency, practicability, economy. The purpose of adjusting calibration intervals is to maintain a given level of instrument quality level at the lowest cost. Having found a satisfactory calibration interval adjustment method, one should look to other components of the entire calibration control system for opportunities to lower costs. Author

N71-23638# Navy Metrology Engineering Center, Pomona, Calif.
INTERVALS BY EXCEPTION
Jerry Glassman *In* NBS Innovative Metrology: Key to Progr. Mar. 1971 p 65–72 refs (See N71-23626 12-14)
Avail: SOD $1.50

Intervals by exception is a new approach devised to control the evaluation and adjustment of calibration intervals. It furnishes management with a powerful tool with which to monitor calibration intervals and assure reliability of equipment. This system is presented with charts that illustrate its operation, outputs, and management-oriented controls. The presentation includes data analyses, adjusting of intervals, detection of statistically poor and statistically good equipments, resultant changes in system operating characteristics, underlying mathematical assumptions, and mathematical models. Author

N71-23639# Lockheed Missiles and Space Co., Sunnyvale, Calif.
OPTIMIZING CALIBRATION INTERVALS
Donald J. Greb *In* NBS Innovative Metrology: Key to Progr. Mar. 1971 p 73–80 ref (See N71-23626 12-14)
Avail: SOD $1.50

A two-method system for using simple attributes calibration data to adjust and optimize calibration intervals is described. The

"fixed interval through data" method is employed where there are at least 27 bits of data, the application being unique in that the data is treated as a random sample from an infinite population, sampling variations are accounted for, and all decisions to extend calibration intervals are characterized by statistical validity. When there are only from 5 to 26 bits of data, the "fixed interval through engineering intuition" method is utilized. However, intuition and judgment are applied only to a set of decision rules, and strong, specific data support is required. Author

N71-23640# General Electric Co., Syracuse, N.Y. Electronics Lab.

OPTIMUM CYCLES DETERMINED WITH CONFIDENCE

P. A. Seamans *In* NBS Innovative Metrology: Key to Progr. Mar. 1971 p 81-84 refs (See N71-23626 12-14)

Avail: SOD $1.50

The calibration history of a family of instruments provides data on how often the instruments were recertified and whether each was in calibration when recertified. These data permit the calculation of the optimum calibration interval for a desired level of confidence in the instrument readings. Three case histories show this method is effective. The histories of a family of oscilloscopes over a thirteen-year period show that calibration cost tends to be roughly constant with time and thus does not seem to follow the bathtub curve. All instruments investigated seem to have equal likelihood of failure in all intervals, and thus the bathtub curve does not seem to hold in general. Author

N71-23644# Martin Marietta Corp., Orlando, Fla. Metrology Lab.

DATA SYSTEM FOR IMPROVING INSTRUMENT RELIABILITY

Frank J. Dyce *In* NBS Innovative Metrology: Key to Progr. Mar. 1971 p 99-104

Avail: SOD $1.50

The importance of monitoring and control of instrument reliability is discussed. It is suggested that a minimum reliability level be set as a goal. The interval adjustment scheme wherein individual instrument performance determines calibration interval as well as repair and surplus is described. A thorough explanation is given of the computerized data system to monitor instrument reliability and to isolate repetitive problem areas. Several examples are given of reliability problems which were solved through use of the system. A unique standardization committee is discussed which justifies the sole-source purchase of general-purpose, reliable electronic test equipment. Author

N71-23646# National Physical Lab., Teddington (England). Div. of Quantum Metrology.

NPL WORK ON THE DETERMINATION OF 2e/h BY THE ac JOSEPHSON EFFECT

B. W. Petley and K. Morris *In* NBS Innovative Metrology: Key to Progr. Mar. 1971 p 111-116 refs (See N71-23626 12-14)

Avail: SOD $1.50

The ac Josephson effect in superconductivity appears to be an exciting possibility for use as a quantum method of maintaining the volt as an SI unit, through the relations 2 eV = hv. A potential divider resistor was devised for precise comparison of a Wesson-cadmium cell with millivolt outputs from various solder-drop junctions excited at 36.8 GHz. The value found for 2 e/h is 483.5941 + or - 0.0010 MHz/microvolt. Author

N71-23647# National Research Council of Canada, Ottawa (Ontario). Radio and Electrical Engineering Div.

THE IMPACT OF ADVANCED ELECTRONIC TECHNOLOGY ON MEASUREMENTS

Richard F. Clark *In* NBS Innovative Metrology: Key to Progr. Mar. 1971 p 117-120

Avail: SOD $1.50

Advances in electronic technology make possible significant improvements in both accuracy and precision of measurements. The increase in accuracy through automatic application of data corrections (which were previously too difficult to be practicable, and the elimination of many human errors is described. Better precision coming from increased speed of measurement and improved control of the environment of the measurement are discussed. Author

N71-23648# National Physical Lab., New Delhi (India).

DESIGN AND DEVELOPMENT THROUGH METROLOGY

Prem Prakash *In* NBS Innovative Metrology: Key to Progr. Mar. 1971 p 121-124 (See N71-23626 12-14)

Avail: SOD $1.50

The National Physical Laboratory adjusted and calibrated mass standards of 50 kg to 1 mg for 250 State Laboratories. Most of the 5000 balances needed by inspectors were designed and fabricated by four commercial manufacturers in India, with specifications, technical training, and performance testing supplied by NPL. With this experience, two manufacturers designed and fabricated the higher precision balances for district-level laboratories. The technique is recommendrd to developing countries faced with similar projects. Author

N71-23698* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

TAPE RECORDER Patent

Paul W. Uber, inventor (to NASA) Issued 12 Aug. 1969 (Filed 6 Sep. 1967) 5 p Cl. 242-192; Int. Cl. G11b15/44

(NASA-Case-XGS-08259; US-Patent-3,460,781; US-Patent-Appl-SN-666551) Avail: US Patent Office CSCL 14C

A tape recorder including a capstan having a resilient, deformable cylindrical drive surface adapted to directly couple and simultaneously drive both magnetic tape takeup and supply reels by frictional surface engagement with the outer layer of magnetic tape carried on the periphery of each reel, is described. The takeup and supply reels are supported on slidably mounted carriages and nonaccumulative force springs are provided to control movement of the carriages with respect to the capstan, so as to maintain a greater contact force between the capstan and the magnetic tape carried on the periphery of the takeup reel than on the magnetic tape carried on the periphery of the supply reel, whereby magnetic tape during transfer between reels is subjected to a desired tension. Official Gazette of the U.S. Patent Office

N71-23699* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

ELECTRON BEAM INSTRUMENT FOR MEASURING ELECTRIC FIELDS Patent

Russell D. Shelton, inventor (to NASA) Issued 30 Sep. 1969 (Filed 10 Oct. 1967) 4 p Cl. 324-72; Int. Cl. G01r31/02

(NASA-Case-XMF-10289; US-Patent-3,470,466; US-Patent-Appl-SN-674356) Avail: US Patent Office CSCL 14B

An apparatus for determining electric field strength is described. The apparatus has an electron discharge device for directing an electron beam in a circular sweep so as to normally impinge for an equal time period each segment of a target having four segments arranged in diametrically opposite pairs. The beam is deflected by an electric field to vary the time each segment is impinged. Control deflection plates are provided to act upon the electron beam in opposition to the applied electric field and the deflection plates are energized in accordance with variations in the time diametrically opposite segments are impinged. A state of equilibrium between the deflection caused by the applied electric field and the deflection

caused by the control deflection plates. The energy required to effect this state of equilibrium is proportional to the applied electric field. Official Gazette of the U.S. Patent Office

N71-23701# Joint Publications Research Service, Washington, D.C.
RELIABILITY COEFFICIENT AS THE MAIN INDICATOR OF GRAVIMETER ACCURACY
G. T. Sobakar 22 Apr. 1971 14 p refs Transl. into ENGLISH from Geofiz Sb., Akad. Nauk Ukr. SSR, Inst. Geofiz. (Kiev), no. 31, 1969 p 111-118
(JPRS-52941) Avail: NTIS

The problems in obtaining gravimetric field observations with precision and consistency are described, and a method of determining the reliability coefficient of gravimeters is outlined. The accuracies of using one, two, three, and four instruments in series are discussed. The optimal number was found to be one highly reliable gravimeter, followed by three instruments whose confidence levels are the same. To obtain reliability coefficients, measurements were made with multiple relationships over a period of several years, and two highly accurate gravimeters were found. N.E.N.

N71-23725* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
BALANCE TORQUEMETER Patent
Joseph C. Boyle, inventor (to NASA) Issued 12 Aug. 1969 (Filed 30 Aug. 1967) 5 p Cl. 73-133; Int. Cl. G01l3/10
(NASA-Case-XGS-10013; US-Patent-3,460,381; US-Patent-Appl-SN-665209) Avail: US Patent Office CSCL 14B

A balance torquemeter for measurement of small torques, particularly those caused by a magnetic dipole moment acting upon a massive body is described. Measurements are made where the body is uncoupled from the torsional stiffness of conventional solid support systems by a hydrostatic support technique enabling measurements under frictionless conditions and where the opposing angular torque is provided by a fine torsion wire. Official Gazette of the U.S. Patent Office

N71-23726* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ANEMOMETER WITH BRAKING MECHANISM Patent
Robert E. Turner and Dennis W. Camp, inventors (to NASA) Issued 9 Sep. 1969 (Filed 15 Aug. 1967) 4 p Cl. 73-189; Int. Cl. G01w1/02
(NASA-Case-XMF-05224; US-Patent-3,465,584; US-Patent-Appl-SN-660842) Avail: US Patent Office CSCL 14B

An anemometer having a wind driven member mounted on a shaft journaled for rotation in a cylindrical base, and a braking mechanism positioned on the base for engagement with the shaft to stop movement of the wind driven member is described. The braking mechanism includes a housing, a brake lever and solenoid mounted on the housing and a linkage connecting the solenoid and brake lever where the brake lever can be pivoted to a position of engagement with the shift journaled for rotation in the base. Official Gazette of the U.S. Patent Office

N71-23748# Environmental Science Services Administration, Rockville, Md. BOMAP Office.
HIGH LEVEL CLOUD PHOTOGRAPHY INVENTORY: BOMEX PERIOD 4, 11 - 28 JULY 1969
Vance A. Myers Mar. 1971 70 p Reprinted
(ESSA-TM-ERLTM-BOMAP-1) Avail: NTIS

The high-level cloud photography missions flown by RB-57F aircraft during the Barbados Oceanographic and Meteorological Experiment (BOMEX) July 11 to 28, 1969 are documented with specific information on the character and location of the photography. The photographic products, the tabulation of cloud photography data, the procedure used to reconstruct flight tracks and position photographs are described with the availability of archived data. Author

N71-23754# Harry Diamond Labs., Washington, D.C.
A JET-EDGE OSCILLATOR FOR SENSING ELECTRICAL CURRENTS
Jonathan E. Fine Oct. 1970 18 p refs
(AD-718249; HDL-TM-70-24) Avail: NTIS

A flueric oscillator was built and tested as a sensor for measuring electrical currents in bridge wires. The conductor (bridge wire) was mounted in one cavity of a jet-edge resonator oscillator. The results of the tests, in which the pressure and temperature of the air supply were held constant and the direct current through the bridge wire was varied from zero to 100 mA, show that the change in oscillator frequency, due to heating the wire, is proportional to the square of the current. The oscillator is used as the sensing element in a fluidic system being developed to measure currents induced in electroexplosive devices by radio or radar transmitters. Author (GRA)

N71-23756* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
APPARATUS FOR TESTING A PRESSURE RESPONSIVE INSTRUMENT Patent
Bumon J. Pruett and Euple I. Palmer, inventors (to NASA) Issued 14 Oct. 1969 (Filed 19 Jan. 1967) 9 p Cl. 73-4; Int. Cl. G01l27/00, Int. Cl. H01h35/26
(NASA-Case-XMF-04134; US-Patent-3,472,059; US-Patent-Appl-SN-610723) Avail: US Patent Office CSCL 14B

A pressure balance that employs a pivotally mounted beam is described. A series of known weights are placed on one end of the beam and the beam is balanced by a piston actuated rod acting on the other end. The pressure in a cylinder in which the piston travels can be calculated by knowing the weight placed on the beam and the piston area. The improved characteristics of this invention results from a control mechanism that monitors the position of the beam and actuates valves to control the pressures exerted against the piston rod and maintain the pivotally mounted beam in a horizontal balanced position. The cylinder pressure is used as a reference to check the accuracy of pressure instruments. Official Gazette of the U.S. Patent Office

N71-23788*# GCA Technology Div., GCA Corp., Bedford, Mass.
MASS SPECTROMETER FOR D-REGION STUDIES. PART 1: LABORATORY TESTS, PHASE 1 Final Report
R. F. K. Herzog Feb. 1971 92 p refs
(Contract NASw-1314)
(NASA-CR-117905; GCA-TR-71-1-N-Pt-1) Avail: NTIS CSCL 14B

The performance of monopole mass spectrometers was thoroughly investigated both theoretically and experimentally. Compared with the quadrupole mass spectrometer, it requires much less power to operate which is most important if heavy molecules have to be analyzed. The mechanical adjustments are less critical and the power supply is much simpler. These properties are of great value for space applications. Counting technique of single ions was used to obtain negative ion spectra. A novel sweep method permits the extension of the regular mass range to very high mass numbers at reduced resolution without increase of the power consumption. The pumping capacity of a titanium getter pump has been investigated. The laboratory tests indicated that the pumping capacity of the titanium getter pump is quite adequate to permit analysis of the ion composition in the d-region with a monopole mass spectrometer. Author

N71-23789# Weston Instruments, Inc., Princeton, N.J. FMR-Photoelectric.

NEW CHARGED PARTICLE DETECTORS Final Report, 1 Nov. 1968 – 1 Jan. 1970

Victor J. Belanger 17 Mar. 1970 75 p

(Contract F19628-67-C-0024)

(AD-718110; AFCRL-70-0482) Avail: NTIS CSCL 18/4

The objectives of the program were to perform experimental investigations directed toward the design and fabrication of new charged particle detectors. The particle detectors are to be used in satellite, rocket, and laboratory experiments to study the magnetospheric boundary regions of space and must be capable of detecting particles with energies of 1 keV or less maintaining high counting efficiency. To attain these goals it was necessary to do extensive field plotting of entry dynode structures in order to arrive at a design configuration that would insure good collection and counting efficiencies, also it was necessary to devise equipment, fixturing, and testing techniques for accurately determining spatially, these efficiencies. Author (GRA)

N71-23790* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

FLOATING TWO FORCE COMPONENT MEASURING DEVICE Patent

Earl D. Knechtel, inventor (to NASA) Issued 10 Dec. 1968 (Filed 18 Aug. 1966) 6 p Cl. 73-141

(NASA-Case-XAC-04885; US-Patent-3,415,116;

US-Patent-Appl-SN-573432) Avail: US Patent Office CSCL 14B

A two-component force balance utilizing a liquid suspended target is described. An arm floats on a liquid on which a force-receiving target is attached the arm. Electrode plates are fastened to the arm and the container holding the liquid. The plates and the dielectric between them form variable capacitors. A force under test alters the capacitance of the capacitors. Servo circuits coupled to electrodes indicate the force components and move the arm and target to null the displacement caused by the force. Official Gazette of the U.S. Patent Office

N71-23797* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

RADIANT ENERGY INTENSITY MEASUREMENT SYSTEM Patent

Edgar S. Davis, inventor (to NASA) Issued 17 Dec. 1968 (Filed 29 Jun. 1966) 7 p Cl. 250-203 Sponsored by NASA

(NASA-Case-XNP-06510; US-Patent-3,417,247;

US-Patent-Appl-SN-562445) Avail: US Patent Office CSCL 14B

A star intensity measuring system which minimizes the effect of outside interference is described. Modifications are made to the circuitry of existing star tracker system in order to measure the signal which is representative of the average intensity of a light source which is scanned by a light source detector with a slit aperture. The revised system reduces the errors in celestial navigation which may be produced by the intensity of illumination from other celestial light sources. P.N.F.

N71-23803# National Bureau of Standards, Washington, D.C. Analytical Chemistry Div.

STANDARD REFERENCE MATERIALS: URANIUM ISOTOPIC STANDARD REFERENCE MATERIALS (CERTIFICATION OF URANIUM ISOTOPIC STANDARD REFERENCE MATERIALS)

E. L. Garner, L. A. Machlan, and W. R. Shields Apr. 1971 155 p refs

(NBS-Spec-Publ-260-27) Avail: SOD $1.25 Catalog No. C13.10:260-27

An ignition procedure yielding reproducible stoichiometry for U_3O_8 was developed. The effects of temperature, length of ignition, rate of cooling, pressure, and type of atmosphere were investigated. A description of the unique features of the mass spectrometer instrumentation including the uranium collector and expanded scale recorder are given. The absolute isotopic abundances of 18 uranium SRMs were determined by thermal emission mass spectrometry. The general approach was to determine absolute U-235/U-238 ratios by using calibration mixes to correct for filament bias. Then the absolute U-234 and U-236 were determined by U-233 isotope dilution. For SRM U-0002, isotope dilution was the only practical means of determining the low abundance of U-235 as well as the U-234. The limits given for the isotopic composition of the uranium SRMs are at least as large as the 95 percent confidence limits for a single determination. Author

N71-24052 Cornell Univ., Ithaca, N.Y.

DEVELOPMENT AND APPLICATION OF A HIGH RESOLUTION MASS SPECTROMETER: COMPUTER SYSTEM

Richard Joseph Klimowski (Ph.D. Thesis) 1969 160 p

Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 70-6002

A small computer for satisfactorily producing significant information for the mass spectrometrist is discussed. The interaction of resolution and errors of mass measurement, the contribution of noise to observed errors, the effect of peak shape on such errors, the techniques of analog and digital signal processing, the criteria of efficient system design, and the fundamental validity of applying a mathematical model, such as the centroid, to a basically statistical situation are detailed. The overall mass measuring accuracy was investigated at resolutions up to R = 10,000 using several different organic compounds and was to be about 12 ppm. Dissert. Abstr.

N71-24091*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CALIBRATION OF PLATINUM RESISTANCE THERMOMETERS

D. H. Sinclair, H. G. Terbeek, and J. H. Malone [1971] 15 p refs Proposed for presentation at 5th Symp. on Temp.: *Its* Meas. and Control in Sci. and Ind., Washington, D.C., 21-24 Jun. 1971; sponsored by Am. Inst. Phys., Instr. Soc. Am., and NBS

(NASA-TM-X-67815) Avail: NTIS CSCL 14B

Results of five years experience in calibrating about 1000 commercial platinum resistance thermometers (PRT) are reported. These PRT were relatively small, and rugged, with ice point resistances from 200 to 5000 ohms. Calibrations normalized in terms of resistance difference ratios (Cragoe Z function) were found to be remarkably uniform for five of six different types of PRT tested and agreed very closely with normalized calibrations of the primary reference standard type PRT. The Z function normalization cancels residual resistances which are not temperature dependent and simplifies interpolation between calibration points when the quality of a given type of PRT has been established in terms of uniform values of the Z function. Measurements at five or six well spaced base point temperatures with Z interpolation will suffice to calibrate a PRT accurately from 4 to 900 K. For most of the six types of PRT included in this report, four basepoint measurements plus Z interpolation produced calibrations within the following limits of error: + or − 0.10 K from 4 to 20 K, + or − 0.02 K from 20 to 77 K, and + or − 0.05 K from 77 to 273 K. Author

N71-24092*# Northrop Corp., Huntsville, Ala.

CALIBRATION OF THE CRYOGENIC DENSITOMETER: AN UPPER ATOMSPHERE DENSITY PROBE

W. W. Youngblood Washington NASA Apr. 1971 49 p refs

(Contract NAS8-20082)

(NASA-CR-1819) Avail: NTIS CSCL 14B

The laboratory calibration of the cryogenic densitometer was completed successfully after a series of mechanical and electronic problems were solved. Results of the calibration were: (1)

The cryogenic densitometer is quite accurate and repeatable over the static pressure range of approximately 0.000001 Torr to 0.001 Torr. (2) The sensitivity of the unit for dry nitrogen gas was determined experimentally to be 1.08 × 10 to the 8th power Hz/gm. (3) The experimentally determined relationship between the unit's frequency response and calibration pressure was found to be approximately delta f/delta t = 385,000 P. (4) The beat frequency of the unit was extremely stable during calibration. (5) A dead-band exists in the frequency response from approximately +5kHz to−5 kHz. (6) Absolute accuracy of the unit was determined to be approximately + or − 5 percent. Author

N71-24129*# Rocketdyne, Canoga Park, Calif.
DEVELOPMENT OF CALORIMETER FOR SPACECRAFT BATTERIES Final Report, 21 Jun. 1970 − 1 Feb. 1971
W. V. Johnston Apr. 1971 75 p refs
(Contract NAS5-21514)
(NASA-CR-118029; R-8468) Avail: NTIS CSCL 14B

A conduction heat flow calorimeter for use in measuring the thermal output of 100 ampere-hour and 20 ampere-hour sealed nickel cadmium cell was designed and constructed. The heat flow calorimeter is composed essentially of a pressurized vessel, thermally isolated from its surroundings in all directions but one, a heat sink maintained at a constant temperature considerably lower than that of the calorimeter, and a copper conductor connecting the two. A heater winding in the calorimeter near the junction with the conductor is supplied with sufficient power to automatically maintain the calorimeter at a constant temperature. Thermal effects taking place in the calorimeter are equal to the adjustments in power required to maintain the thermal head. A wattmeter, accurate and precise to 0.2% measures the power changes. The calorimeter will measure a heat flow of 30 watts with a resolution of 0.01 watts. The calorimeter operates over a temperature of −10 C to 40 C. The results of cycling 20 A-H and 100 A-H nickel cadmium cells are included. Author

N71-24130 Cornell Univ., Ithaca, N.Y.
THEORY OF FLAT PLATE AND CYLINDRICAL ION DENSITY PROBES
Ronald Albert Johnson (Ph.D. Thesis) 1969 126 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 70-5998

The flat plate and the cylinder are assumed to be aligned parallel with the flow. Both the free molecular and continuum regimes are considered. Special attention is given to the flat-plate continuum case. The results of three methods are found to agree in the downstream limit, but the results are different near the leading edge. It is shown how a measurement of the total current collected by the probe can be used to infer the free stream ion number density. For the flat plate continuum case, the influence of ion production inside the ion sheath is investigated. The production arises because the electron number density inside the sheath is far below its equilibrium value. In the downstream limit, the sheath thickness has a constant value, which depends on the rate of production. The corrections arising from the presence of the viscous boundary layer are found to be small, even when the boundary layer thickness is of the order of the sheath thickness. Dissert. Abstr.

N71-24131 Purdue Univ., Lafayette, Ind.
AN ANALYSIS OF THE EFFECTS OF RESISTANCE THERMOMETERS IN A THERMOPHYSICAL PROPERTIES INSTRUMENT
William Edward McCracken (Ph.D. Thesis) 1969 158 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 70-10676

The effects of using resistance thermometers to measure the temperatures of the cylindrical walls bounding a test fluid in a thermophysical properties instrument is presented. A mathematical model is used to represent the actual instrument. Then the analytical nonhomogeneous heat conduction equation for cylindrical coordinates (r,z) is approximated by a discrete set of difference equations. The physical method of simple heat balances is used to derive the nodal equations for the thermal heat cell. The heat cell is composed of various materials with different conductivities. The variation from unity of the shape factor ratios is negligible as far as experimental measuring techniques are concerned for each case. Thus, the measured temperature actually indicates the isothermal temperature of the undisturbed portion of the wetted wall. Results indicate that thermal conductivity data on liquids and gases can now be measured within several tenths of a per cent. Dissert. Abstr.

N71-24188 Stanford Univ., Calif.
THE CIRCULAR DISC VISCOMETER AND RELATED ELECTROSTATIC PROBLEMS
Susann Jane Novalis Shaw (Ph.D. Thesis) 1969 83 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 70-10523

The method of matched asymptotic expansions is applied to a set of singular perturbation problems. Formal series solutions are assumed for the potential in the three regions recognized by Kirchhoff. These series solutions are assumed to be the asymptotic expansions in each region, as epsilon approaches zero, of the complete exact solution; this principle permits matching of the series solutions in the assumed overlap regions. Expansions are found for the velocity and potential; these are integrated to obtain the turning moment and capacitance. For the two-dimensional systems the plate thickness is assumed finite and the second-order approximation, including terms of order epsilon, is obtained for the capacitance and force per unit length. For the three-dimensional systems, negligible plate thickness is assumed in order to facilitate the determination of the higher-order terms for the expansion valid in the edge region. Dissert. Abstr.

N71-24189 National Lending Library for Science and Technology, Boston Spa (England).
THE MICROENCAPSULATION OF PHOTOGRAPHIC EMULSION
Soichi Kubo et al 19 Jan. 1971 9 p Transl. into ENGLISH from Chiba Diagaku Kogakubu Kenkyu Hokoku (Chiba), v. 21, no. 39, [1970] p 19−26
(NLL-M-20169-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

New technology is being developed in the search for applications of microencapsulation in all fields of science and technology, and it is possible that microencapsulation will find wide application in the field of photographic technology. Microencapsulation has already been applied to the mixed particle technique for colour sensitive materials, and some research has been carried out on the use of microencapsulated processing chemicals to simplify photographic processing procedures. The aim of the present study was to achieve microencapsulation of a photosensitive emulsion whereby a coating of polymeric colloid containing silver ions is formed around a nucleus comprising a droplet of an organic solvent; the solvent contains a solute which reacts either directly or indirectly with the sensitive element, a gelatin emulsion of silver halide. Author

N71-24190 National Lending Library for Science and Technology, Boston Spa (England).
ANALYSIS OF THE ACCURACY OF AN INSTRUMENT FOR MEASURING THE SIZE OF FOG DROPLETS AND AEROSOL PARTICLES
V. I. Golikov et al 24 Jan. 1971 5 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), 1969 p 308−311

(NLL-M-20291-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The instrument for measuring particle sizes and counting particles can be classed according to its measurement principle as a pulse photometer. Size of particles is determined by measuring the luminous flux in a solid angle of nearly 2 pi steradians; only the geometrical component of the indicatrix is used. Thus the physical source of information about particle size is the luminous flux due to scattering. Measurement of particle sizes is a process of comparing the luminous flux from a particle with a scale of equivalent luminous fluxes. The size of a particle to be measured is functionally related to the result of the measurement by way of the parameters of the units described in the instrument scale equation. Author

N71-24193 National Lending Library for Science and Technology, Boston Spa (England).

AN ELECTRONIC INTERPOLATION METHOD FOR LIGHTWARE INTERFERENCE [EIN ELEKTRONISCHES INTERPOLATIONSVERFAHREN FUER LICHTINTERFERENZES]

J. Naumann 19 Jan. 1971 20 p Transl. into ENGLISH from Zeiss-Mitt. Fortschr. Tech. Op. (Stuttgart), v., no. 1/2, 1969 p 5-30

(NLL-Trans-T-6783-(5809.95)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The signals produced by interference fringe scanning are discussed and the rotary field method used with an interpolator for linear measurements is described. The equations for functions of a 2-phase and 3-phase interpolator are derived for the examination of interpolation errors. Author

N71-24197*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

SKYLAB FILM USAGE ANALYSIS PROGRAM

Ronald A. Schlagheck 21 Apr. 1971 76 p

(NASA-TM-X-64585) Avail: NTIS CSCL 14E

A computer model for a film usage analysis of the Skylab missions is described. The major objectives of the program are to predict the total time that each film canister will be out of the radiation vault and to verify the compatibility between the principal investigators' film requirements and the amount of time allocated for filming during the mission. The program is written in GASP IIA simulation language. The description and format for the input data are given. An example problem, as well as a sample output, is explained. The program description includes an execution flow chart, subprogram definitions, variable definitions, array limitations, and a FORTRAN listing of both the user written routines and the GASP routines. Author

N71-24231 National Lending Library for Science and Technology, Boston Spa (England).

ON OPTIMUM STABILIZATION OF ROTARY MOTION OF A RIGID BODY BY MEANS OF CONTROL GYROS

V. V. Krementulo et al 16 Feb. 1971 17 p refs Transl. into ENGLISH from Mekhan. Tveld. Tela (USSR), no. 5, 1969 p 3-9 In ENGLISH and RUSSIAN

(NLL-M-20349-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The optimum stabilization for a free rotating rigid body with control gyros mounted by Cardan suspension was studied. Beginning with equations of motion and the assumption that the plane of the outer and inner Gimbals do not coincide, the equations which solve the problem of optimum stability are developed. F.O.S.

N71-24232* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

DEVICE FOR MEASURING PRESSURE Patent

Milton C. Kells, inventor (to NASA) Issued 16 Jul. 1968 (Filed 8 Mar. 1966) 8 p Cl. 73-400

(NASA-Case-XAC-04458; US-Patent-3,392,586; US-Patent-Appl-SN-534975) Avail: US Patent Office CSCL 14B

An improved McLeod gauge with means for eliminating the mercury diffusion effect is described. A valve seat and a valve member are positioned below the compression chamber and between the compression chamber and the mercury reservoir. Before equilibrium, the mercury is raised to the valve seat (to prevent trapping gas) and the valve member is closed against the valve seat. In this manner, mercury vapors from the mercury reservoir are prevented from pumping gas molecules (of the gas under measurement) toward the inlet and away from the compression chamber, and appreciable measurement errors are obviated. Official Gazette of the U.S. Patent Office

N71-24233* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

STRAIN GAUGE MEASURING TECHNIQUES Patent

Frank J. Cepollina, inventor (to NASA) Issued 12 Aug. 1969 (Filed 20 Jul. 1966) 4 p Cl. 73-88.5; Int. Cl. G01b7/16

(NASA-Case-XGS-04478; US-Patent-3,460,378; US-Patent-Appl-SN-566717) Avail: US Patent Office CSCL 14B

A method for measuring strain is described which provides a simultaneous separate and independent measurement of the following parameters: (1) elongations of specimens due solely to thermal stress; (2) elongations of specimens due to mechanically induced stress; and (3) elongations due to the combined effect of thermal and mechanically induced stress. The method calls for combining in a double bridge circuit, the outputs of an active strain gauge sensor which is both thermally and mechanically coupled to a test specimen, the outputs of a dummy sensor which is thermally and mechanically coupled to a supporting plate which is only thermally coupled to the specimen, and the outputs of a second dummy sensor which is directly thermally connected to the specimen. Official Gazette of the U.S. Patent Office

N71-24234* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

HORIZONTAL CRYOSTAT FOR FATIGUE TESTING Patent

Orvil Y. Reece, inventor (to NASA) Issued 30 Sep. 1969 (Filed 2 Jun. 1967) 4 p Cl. 73-15.6; Int. Cl. G01n25/02

(NASA-Case-XMF-10968; US-Patent-3,469,437; US-Patent-Appl-SN-644447) Avail: US Patent Office CSCL 14B

A cryostat for use with horizontal fatigue testing machines for testing materials at cryogenic temperatures is described. The cryostat, a rectangular Dewar vessel, is apertured on opposite sides for entry of horizontal load rods. At each aperture the load rod is held in position and a seal is provided by an outer sleeve joined to the walls, and inner Teflon sleeve, and a Teflon washer. The Teflon sleeve contracts tightly around the load rod at cryogenic temperature to minimize cryogen loss, while allowing free longitudinal movement of the rod. Official Gazette of the U.S. Patent Office

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N71-23147# Royal Aircraft Establishment, Farnborough (England).

THE DEVELOPMENT OF A BEARING SYSTEM FOR THE DESPUN ANTENNA OF A SPIN STABILIZED SATELLITE. PART 1: BASIC INVESTIGATIONS [ENTWICKLUNG

EINES LAGERS FUER DIE ENTDRALLTE ANTENNE EINES SPINSTABILISIERTEN SATELLITEN. TEIL 1: GRUNDLEGENDE UNTERSUCHUNGEN]
M. Granz et al Oct. 1970 90 p refs Transl. into ENGLISH of Bundesminsterium fuer Wiss. Forsch., Bad Godesberg, W. Ger., report BMwF-FB-W67-33
(RAE-Lib-Trans-1450; BMwF-FB-W67-33) Avail: NTIS

The investigations on components of a bearing system suitable for space application are described. Various bearing types, combinations of materials, lubricants and lubrication methods are tested under simulated environmental conditions. The result of these investigations leads to the selection of the most appropriate components of a bearing system for mechanically de-spun antenna of a spin-stabilized communication satellite. Author

N71-23169*# Allied Chemical Corp., Morristown, N.J.
OXYGEN DIFLUORIDE HANDLING MANUAL Final Report
Ralph B. Jackson Dec. 1970 55 p refs
(Contracts NAS3-2564; NA3-6298)
(NASA-CR-72401) Avail: NTIS CSCL 13L

General information covering chemical and physical properties as well as appearance, solubility, and stability of OF2 are reviewed. Compatible and noncompatible materials, and proper cleaning and passivation techniques are discussed. Health and fire hazards, OF2 toxicity and physiological effects as well as first aid are included together with methods for reducing hazards. Safety measures include protective clothing in addition to facility and personal safety equipment. Decontamination methods to be used to neutralize spills and leaks, and the disposal of surplus OF2 are discussed. The transfer and storage are covered including materials, equipment, and procedures to be used for OF2. The applicable laws, marking and packaging procedures are also listed. Author

N71-23254* National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
THREADLESS FASTENER APPARATUS Patent
Joseph Darr, Jr. and Ralph E. Cissell, inventors (to NASA) Issued 13 May 1969 (Filed 24 Nov. 1967) 4 p Cl. 85-7; Int. Cl. F16b19/00, 21/00; Int. Cl. A44b17/00
(NASA-Case-XFR-05302; US-Patent-3,443,472; US-Patent-Appl-SN-685463) Avail: US Patent Office CSCL 13E

A nonseparable fastener for securing a series of articles with registered fastener receiving apertures is described. The device is assembled into a self-locked condition without exceeding the elastic limits of the components, thus permitting the use of non-malleable materials in both ends of the fasteners. The bolt may provide fastening by a single operator by including a puller knob on a tensilely frangible extension. The device is easily installed and vibration resistant. E.M.C.

N71-23265* Honeywell, Inc., Minneapolis, Minn.
CONTROLLERS Patent
Don P. Miller, inventor (to NASA) Issued 5 Nov. 1968 (Filed 19 Sep. 1966) 4 p Cl. 244-83 Sponsored by NASA
(NASA-Case-XMS-07487; US-Patent-3,409,252; US-Patent-Appl-NS-580365) Avail: US Patent Office CSCL 13I

A hand controller is described which is operable about three respectively perpendicular axes corresponding to the conventional axes of a flight vehicle. Rotary motion of the controller about a particular axis is transmitted mechanically to operate two signal generators for actuating appropriate attitude control devices. The use of universal joints obviates the need for wires which couple the signal generators with detectors of mechanical movements of the controller and also permits operation of the device without cross coupling effects. Drawings of the device are included. E.M.C.

N71-23266* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
EVACUATION PORT SEAL Patent
John A. Woller, inventor (to NASA) Issued 10 Dec. 1968 (Filed 12 Aug. 1965) 3 p Cl. 53-22
(NASA-Case-XMF-03290; US-Patent-3,415,032; US-Patent-Appl-SN-479353) Avail: US Patent Office CSCL 11A

A method is described for evacuating a vacuum container and sealing the evacuation port of the container. A rigid evacuation tube is coated with lubricant and inserted into a relatively thin-walled flexible tube extending from the vacuum container and communicating with the evacuation port. The container is evacuated via the rigid tube which is then withdrawn from the flexible tube with an attendant collapse of the unsupported portion of the flexible tube. The flexible tube is temporarily clamped while a permanent seal is made adjacent the free end of the flexible tube permitting reuse of the tube for evacuating by cutting off the permanently sealed end. Official Gazette of the U.S. Patent Office

N71-23276# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EXPERIMENTAL INVESTIGATION OF THE EFFICIENCY OF MODULAR GEARED ELECTROMECHANISMS IN A VACUUM
G. P. Derimyan 25 Nov. 1970 9 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Mashinostro. (Moscow), no. 11, 1969 p 71-74
(AD-717894; FTD-HT-23-709-70) Avail: NTIS CSCL 13/9

A report is given of an experimental investigation of the efficiency of modular gearings (such as found in the control equipment of commerical aircraft) operating in a vacuum up to about 10(minus superscript 6) torr. The test unit was developed by the author and is discussed briefly. Graphs are presented which reflect the relationship of the efficiency of the electro-mechanical gearings to the degree of vacuum and the rpm of the gearings, with no lubrication and under no load. Author (GRA)

N71-23297# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CENTRIFUGAL COMPRESSOR MACHINES
F. M. Chistyakov et al Dec. 1970 443 p refs Transl. into ENGLISH of the Book "Tsentrobezhn. Kompressornye Machiny" Moscow, Izd-vo Mashinostr., 1969 p 1-327
(AD-717878; FTD-MT-24-183-70) Avail: NTIS HC $8.00/MF $0.95 CSCL 13/7

The book discusses fundamentals of theory, calculation and design of centrifugal compressor machines. There are examined processes of flow and losses in elements of the stage and the effect of separate structural factors of the flow area on efficiency. There is substantiated the rational selection of elements of the flow area: rotor wheel, diffuser, return stator, and volute. There are provided calculations of compressor machines with cooling, calculations of disks for strength and of shaft for critical number of revolutions. There are examined systems of automatic control of compressor machines, and also questions of their testing. Author (GRA)

N71-23299# Radio Corp. of America, Lancaster, Pa.
DEVELOPMENT OF A 1 TO 2 KILOWATT ALKALI METAL VAPOR ARC LAMP Final Report
S. W. Kessler and R. R. Carbonetta Jul. 1970 71 p refs
(Contract DAAK02-68-C-0061)
(AD-718877; FR-1) Avail: NTIS CSCL 13/1

The design, fabrication and evaluation of a compact 1 to 2 kilowatt alkali metal vapor arc lamp was accomplished. The feasibility of using a noble gas for Cold Starting and subsequent kilowatt operation was determined to be practical. A prototype lamp was successfully operated for a period of 300 hours at 1250 watts at a pressure of 100 Torr. The lamp was also operated at 1500

watts at 100 Torr in accordance with contract objectives. Two modes of operation, the ignited and the extinguished, were observed and studied. Fabrication and evaluation of a parametric test lamp established the existence of a relationship between optimum arc gap and sapphire bulb diameter. Author (GRA)

N71-23300# California Univ., Los Angeles. School of Engineering and Applied Science.

HIGH RATE ANODIC NICKEL DISSOLUTION IN NaCl AND NaClO3

Madhav Datta and Dieter Landolt Jan. 1971 59 p refs
(Contract N00014-69-A-0200)
(AD-718900; UCLA-ENG-7102) Avail: NTIS CSCL 13/8

An experimental investigation, to provide fundamental electrochemical data on the dissolution mechanism of nickel 200 in NaClO3 at high rates, was conducted. The investigation was principally concerned with the study of dissolution kinetics and stoichiometry. In chlorate solution, nickel showed passive-transpassive behavior while in chloride solution active dissolution took place. Presence of small amounts of chloride ions (0.01 N to 0.1 N) in chlorate solution changed the passive-transpassive behavior towards active dissolution. Current efficiency for dissolution was determined from anode weight loss measurements. In chlorate solution, a sharp rise of dissolution efficiency was observed between 3 amp/sq cm and 8 amp/sq cm beyond which a limiting efficiency of 58% was obtained. In chloride solution the efficiency was 100%. In chlorate solution containing 0.01 N to 0.1 N chloride ions, the dissolution efficiencies were calculated to be more than 100% at high current densities. Author (GRA)

N71-23730*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EXPERIMENTS ON THE STABILITY OF WATER LUBRICATED THREE LOBE HYDRODYNAMIC JOURNAL BEARINGS AT ZERO LOAD

Fredrick T. Schuller Washington Apr. 1971 24 p refs
(NASA-TN-D-6315; E-6050) Avail: NTIS CSCL 13I

Hydrodynamic journal bearing stability tests were conducted with three-lobe bearings with and without axial grooves. The bearings had a 3.8 cm (1.5 in.) diameter and length and were tested in water at 300 K (80 F) at speeds to 7000 rpm with zero load. Whirl threshold speed decreases with increasing clearance at a much faster rate in ungrooved than in grooved three-lobe bearings. Tests were conducted with symmetric three-lobe bearings. Results are compared with previous tests of asymmetric lobed bearings. Maximum stability and least sensitivity to clearance are obtained with a three-lobe bearing when the lobes are tilted so that the minimum film thickness occurs at about the trailing edges of the lobes. Author

N71-23747*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

THERMOCHEMISTRY OF BINARY ALLOYS AND ITS EFFECT UPON FRICTION AND WEAR

Donald H. Buckley Washington Apr. 1971 13 p refs
(NASA-TN-D-6311; E-6136) Avail: NTIS CSCL 07D

Friction experiments were conducted with binary alloys of the noble metals in sliding contact with iron to determine the influence of alloy thermochemistry on friction and wear. Results indicate that the greater the free energy of formation of the binary alloy, the lower the friction and wear when sliding on iron. This is believed to be due to a reduction in the valence electrons available for interaction of the alloy with the iron surface. Crystal structure exerts an influence on observed behavior. Author

N71-23758# Martin Marietta Corp., Denver, Colo.

CENTER FOR HIGH ENERGY FORMING Quarterly Report, 1 Oct. - 31 Dec. 1970

Jimmy D. Mote 1 Jan. 1971 26 p
(Contract DA-19-066-AMC-266(X); ARPA Order 720)
(AD-718079; AMRA-CR-66-05/27; QR-22) Avail: NTIS CSCL 13/8

Contents: Investigation of Dautriches Method for Measurement of Explosive Detonation Velocity: Application of Explosive Welding to Hardward Configurations; Flange Buckling of Explosively Formed Domes; Cylindrical Explosive Forming Dies; Explosive Forming of Domes in Vented Die; Explosive Forming of Domes for Ground Based Pressure Vessels; The Edge Pull-In of Explosively Formed Domes; Fracture Toughness of Explosively Formed High Strength Steel; Explosive Welding; Explosive Powder Compaction; Explosive Forming of Thick Walled Domes; Theoretical Studies of Explosive Energy Transfer to a Thick Walled Cylinder Using a Radial Piston; Explosive Thermomechanical Processing. Author (GRA)

N71-23769# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

STATIC CHARACTERISTICS OF GAS DYNAMIC BEARINGS

I. V. Yakovlev 30 Nov. 1970 12 p ref Transl. into ENGLISH from Aviats Inst., Moscow. Tr. (USSR), no. 180, 1968 p 113-120
(AD-718289; FTD-HT-23-717-70) Avail: NTIS CSCL 13/9

Discussion is presented of the principles of operation of dynamic gas bearings, and their performance under various conditions. The advantages, shortcomings, and applications of gas bearings are examined. Guidelines are proposed for selecting materials with identical thermal expansion coefficients, the optimum clearances, and proper surface hardness. The principal characteristics of gas bearings are outlined, and a computer method for solving the bearing equations is proposed. Author (GRA)

N71-23760# Oceanautics, Inc., San Diego, Calif.

HUMAN ENGINEERING CRITERIA FOR THE DESIGN OF DIVER OPERATED UNDERWATER TOOLS Annual Summary Report, Oct. 1969 - Sep. 1970

Birger G. Andersen Jan. 1971 79 p refs
(Contract N00014-70-C-0070)
(AD-717961; OI-TR-71/1-SK) Avail: NTIS CSCL 13/9

The report summarizes the results of a research study conducted to develop a user-oriented design criteria guide for diver-operated underwater tools. The tools covered in this phase of the study were limited to the category of tools used in the performance of torqueing tasks. The rationale for the development of design criteria is presented for those hand and power operated torqueing tools used by military and commercial divers in the support of underwater construction and salvage operations. The tool items studied include screwdrivers, nutrunners, hand wrenches, and pneumatic and hydraulic powered impact wrenches. The applications of specific tool items are discussed in relation to the performance of operational underwater work tasks. Design criteria are presented, based on direct observation and participation in underwater tool operations, available tool performance data, applicable human engineering research data, and the operational experience of commercial and military divers. Author (GRA)

N71-23771# SKE Industries, Inc., King of Prussia, Pa. Research Lab.

SCANNING ELECTRON MICROSCOPY STUDY OF 6309 SIZE BEARINGS Final Report

Laurence Leonard, Gerald Cotellesse, and Karl Erhardt 31 Jan. 1971 83 p refs
(Contract N00014-70-C-0229)
(AD-717959; SKF-AL71C002) Avail: NTIS CSCL 13/9

The report covers a study of 6309 size ball bearings in which the techniques of scanning electron microscopy were employed to follow the details of the very localized surface alterations which occur during running. This work reveals by scanning electron

microscopy (SEM) various aspects of bearing surface finishing, the effects of surface morphology upon alterations induced by running, and the fine details of these very localized alterations. Surface phenomena observed in this study include pitting, denting, spalling, finger nail marks, plastic deformation and large complex dent-and-pit defects. The latter were a novel type of defect upon which one can postulate a model to account for the small L sub 10 lives of some test groups run under high h/sigma test conditions. Author (GRA)

N71-23772# Westinghouse Electric Corp., Lima, Ohio. Aerospace Electrical Div.
COMPUTER REPRESENTATIONS OF ELECTRICAL SYSTEMS ON WHEELED VEHICLES Final Report
W. E. Hyvarinen Jan. 1971 132 p refs
(Contract DAAE07-67-C-1563)
(AD-718075; TACOM-TR-10831) Avail: NTIS CSCL 13/6

Various wheeled vehicle electrical systems were evaluated based on operation and maintenance manuals and selected equipment and circuit testing. Mathematical models were developed for different types of equipment for representation on the analog computer. The mathematical analysis includes overall system operation in the steady state and transient conditions, as well as expected impact of the individual components and transmission line parameters (including coupling effects). Where applicable test data is compared to the mathematical analysis to verify proper component and system model representation. Author (GRA)

N71-23775*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PROCESS AND APPARATUS FOR MAKING DIAMONDS
J. R. Rasquin, Marvin Estes, and David Webb 4 Sep. 1970 22 p refs
(NASA-TM-X-64543) Avail: NTIS CSCL 13H

A method of synthesizing diamond grit is described. The grit is polycrystalline in nature and of sizes typically used for grinding and lapping processes. Author

N71-23776*# National Aeronautics and Space Administration. Washington, D.C.
WELDING TECHNOLOGY: A COMPILATION
1970 25 p
(NASA-SP-5918(01)) Avail: NTIS CSCL 13H

Innovations in the technique of joining metals which provide a degree of efficiency adequate to contain gases at high pressures or fluids through a wide temperature range are described. Means for the handling of difficult weld configurations (circular, concentric, right-angled, etc) are also described. Even those tubes previously considered almost inaccessible can be welded with little or no risk of distortion, as can large surface of varying thickness. Author

N71-23782*# National Aeronautics and Space Administration. Washington, D.C.
SEALS AND SCALING TECHNIQUES: A COMPILATION
1970 17 p refs
(NASA-SP-5905(02)) Avail: NTIS CSCL 11A

Technical information on selected seals and sealing techniques are summarized. Topics discussed include: fluorocarbon seal replacement for metal piston ring, low temperature applications, seal lock, seal for emergency escape window, and techniques for improving and forming seals. F.O.F.

N71-23798* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ELECTRIC WELDING TORCH Patent
Gilbert V. Allen, inventor (to NASA) Issued 23 Sep. 1969 (Filed 12 Jan. 1967) 5 p Cl. 219-130; Int. Cl. B23k9/12, 9/16
(NASA-Case-XMF-02330; US-Patent-3,469,069; US-Patent-Appl-SN-608944) Avail: US Patent Office CSCL 13H

An electric welding apparatus that includes a welding head having a cylindrical casing at one end that forms an inert-gas shield is described. A fixed electrode is mounted in a canted and offset position in the casing by means of a conductive collar mounted to the interior surface of the casing. Filler wire from a feeder mechanism is fed through the center of the welding head to a weld puddle. Cooling water and inert shielding gases are routed to the weld area through conduits in the welding head. Official Gazette of the U.S. Patent Office

N71-23799# Southwest Research Inst., San Antonio, Tex.
DEVELOPMENT OF NONDESTRUCTIVE TESTING TECHNIQUES FOR DETECTING STRESS IN BRITTLE MATERIALS Quarterly Technical Progress Report
C. G. Gardner and G. A. Matzkanin 14 Jan. 1971 8 p
(Contract N00156-69-C-0856; ARPA Order 1247)
(AD-718426; QTPR-2) Avail: NTIS CSCL 13/8

Continuation of research efforts using the inductive coil technique for studying the Barkhausen effect are reported. GRA

N71-23809* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CONTROL DEVICE Patent
Nozomu Iwasaki and Wayne O. Hadland, inventors (to NASA) Issued 14 Oct. 1969 (Filed 28 Nov. 1967) 4 p Cl. 74-89.19; Int. Cl. F16j15/50
(NASA-Case-XAC-10019; US-Patent-3,472,086; US-Patent-Appl-SN-686209) Avail: US Patent Office CSCL 13I

A potentiometer mounted on a small housing or bracket with a driving wheel or disc secured to the shaft is described. A sector of the disc is provided with gear teeth and another sector is provided with a cam profile against which a cam follower acts. The cam follower is carried on a slide and is urged to engage with the cam profile by a biasing spring or the like which acts against a bearing member. The spring acts on the bearing member in a direction toward the cam profile so as to balance the force transmitted to the shaft by the cam follower itself. A large internal gear sector is pivotly mounted on the frame so that movement through a relatively small arc will produce rotation of the cam through its complete profile. The frame is adapted to be secured to some operating member of aircraft such as the steering wheel or control yoke and an arm secured to the internal gear sector extends immediately adjacent to the steering wheel so that it is within easy reach of the pilot's thumb. Official Gazette of the U.S. Patent Office

N71-23810* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ALLOYS FOR BEARINGS Patent
Donald H. Buckley and Robert L. Johnson, inventors (to NASA) Issued 9 Sep. 1969 (Filed 29 Nov. 1965) 3 p Cl. 252-12; Int. Cl. C10m5/28; Int. Cl. C22b23/00
(NASA-Case-XLE-05033; US-Patent-3,466,243; US-Patent-Appl-SN-510474) Avail: US Patent Office CSCL 13I

Metal alloys with hexagonal crystalline form for minimizing surface failures in mechanical components having static, sliding, or rolling contact are discussed. The lattice structure of the hexagonal metals is expanded to increase the crystal height. Official Gazette of the U.S. Patent Office

N71-23811* Honeywell, Inc., Minneapolis, Minn.
CONVOLUTING DEVICE FOR FORMING CONVOLUTIONS AND THE LIKE Patent

Raymond E. Michel and Dallas E. Nelson, inventors (to NASA) Issued 13 May 1969 (Filed 17 May 1967) 5 p Cl. 72-354; Int. Cl. B21d22/10, 5/02; Int. Cl. B21j7/02 Sponsored by NASA
(NASA-Case-XNP-05297; US-Patent-3,443,412; US-Patent-Appl-SN-640458) Avail: US Patent Office CSCL 13I

The device includes an opposed punch and die mechanism having grooved working surfaces which mate with the hemisphere sandwiched between. The punch is formed of telescoping segments which are extended to an operative hemispheric configuration by pneumatic pressure. The die is coaxially aligned with the punch and extends in a single plane so that the hemisphere may be sandwiched between the working surfaces with the segments of punch being retracted progressively from the center, and the convolutions progressively formed as the working surfaces are progressively displaced toward each other. Since the blank is of a hemispheric configuration, the convolutions will be formed without effecting a stretching or drawing of the metal, thus the hemisphere is crushed or driven toward a planar configuration in the formation of the convoluted diaphragm.

Official Gazette of the U.S. Patent Office

N71-23812* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SWIVEL SUPPORT FOR GAS BEARINGS Patent
Helmuth Pfaff, inventor (to NASA) Issued 26 Aug. 1969 (Filed 20 Nov. 1967) 4 p Cl. 308-2; Int. Cl. F16c7/00, 9/00, 11/00
(NASA-Case-XMF-07808; US-Patent-3,463,563; US-Patent-Appl-SN-684178) Avail: US Patent Office CSCL 13E

A spherical supporting cup for the ball of a gas bearing with the cup being capable of being swiveled to change its relative position to the ball while the bearing is under high load is described. This adjustability was found to enable a substantial decrease in gas bearing disturbance torques caused by a lack of optimum fit between the ball and the cup due to manufacturing tolerances. A shaft is rigidly connected to the supporting cup in the center and projects below the cup with the lower end of the shaft being provided with means of swivelling the shaft and thus the gas bearing supporting cup. Official Gazette of the U.S. Patent Office

N71-23813*# Scientific Translation Service, Santa Barbara, Calif.
GAS FLAME SPRAYING OF ZrO2 AND Al2O3 COATINGS WITH ALUMINUM PHOSPHATE ADDITIONS [GAZOPLAMENNOYE NAPYLENIYE POKRYTIY IZ ZrO2 I Al2O3 S DOBAVKOY ALYUMOFOSFATA]
A. S. Frolov et al Washington NASA Apr. 1971 13 p refs Transl. into ENGLISH from the publ. 'Vysokotemperaturnyye Pokrytiya. Trudy Seminara po Zharoskoykim Pokrytiyam, Leningrad, 26–28 May 1965' Moscow, Nauka, 1967 p 153–161
(Contract NASw-2035)
(NASA-TT-F-13555) Avail: NTIS CSCL 13H

Experimental investigation of the influence of aluminum phosphate additions on the thermal stability and adhesive properties of erosion resistant high melting ZrO2 and Al2O3 coatings deposited by the gas flame method on 1Kh18N9T, BRKh08, and BZh98 alloys. It is found that ZrO2 and A12O3 coatings with aluminum phosphate additions provide satisfactory protection of the alloys studied against the erosive and high temperature effects of gas flows. Author

N71-23814*# Techtran Corp., Glen Burnie, Md.
PROCESSES OF FORMATION OF COATINGS DEPOSITED BY THE METHOD OF GAS FLAME SPRAYING [PROTSESSY FORMIROVANIYA POKRITIY, NANOSIMYKH METODOM GAZOPLAMENNOGO NAPYLENIYA]
L. D. Svirskiy et al Washington NASA Mar. 1971 12 p refs Transl. into ENGLISH from the publ. 'Temperaturoustoychivyye Zashchitnyye Pokrytiya; Trudy, Seminar po Zharostoykim Pokrytiam, 3-ogo, Leningrad, 27–31 May 1968' Leningrad , Nauka, 1958 p 232–239
(Contract NASw-2037)
(NASA-TT-F-13534) Avail: NTIS CSCL 13H

The temperature of the coated surface depends on the thickness of the backing, the time for depositing the coating and the distance of this surface from the nozzle of the gun. The conditions for formation of the coatings are discussed. Author

N71-23815* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
WELDING SKATE WITH COMPUTERIZED CONTROL Patent
William A. Wall, Jr., inventor (to NASA) Issued 23 Sep. 1969 (Filed 2 Oct. 1967) 29 p Cl. 219-125; Int. Cl. B23k9/12
(NASA-Case-XMF-07069; US-Patent-3,469,068; US-Patent-Appl-SN-672382) Avail: US Patent Office CSCL 13H

An apparatus for automatically varying a skate or carriage speed to obtain a substantially constant traversal speed of the welding torch along the work surface is described. Control is accomplished through utilization of an analog computer which combines electrical inputs, representing various parameters of a carriage type system, and computes the instantaneous skate or carriage velocity for a constant welding speed.

Official Gazette of the U.S. Patent Office

N71-23816* Goodyear Aerospace Corp., Akron, Ohio.
FILAMENT WOUND CONTAINER Patent
Clem B. Shriver, inventor (to NASA) Issued 16 Jul. 1968 (Filed 29 Oct. 1965) 6 p Cl. 220-9 Sponsored by NASA
(NASA-Case-XLE-03803; US-Patent-3,392,865; US-Patent-Appl-SN-505765) Avail: US Patent Office CSCL 13D

Insulation for a cryogenic storage tank in the form of foam that is encapsulated in a vacuum-tight casing is described. A bleeder ply is positioned between the foam and the vacuum jacket to provide a path for conducting gases from the casing.

Official Gazette of the U.S. Patent Office

N71-23817* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXTRUSION DIE FOR REFRACTORY METALS Patent
Charles A. Gyorgak and Robert J. Hoover, inventors (to NASA) Issued 30 Sep. 1969 (Filed 14 Jun. 1967) 4 p Cl. 72-467; Int. Cl. B21c3/00
(NASA-Case-XLE-08773; US-Patent-3,469,436; US-Patent-Appl-SN-646124) Avail: US Patent Office CSCL 13I

An extrusion die for refractory metals is described. The die is a frusto-conical die nib fitted into a fustro-conical receptacle in a die nib holder, a cylindrical throat in the small end of the die nib opening into a cup in the lower surface of the die nib holder, a tapered passage being disposed between the throat and the cup in the die nib and contiguous with the throat.

Official Gazette of the U.S. Patent Office

N71-23910*# National Aeronautics and Space Administration, Washington, D.C.
HAND TOOLS: A COMPILATION
1970 27 p refs
(NASA-SP-5908(03)) Avail: NTIS CSCL 13I

Mechanical and electrical tools which have potential utility outside the aerospace industry are described. Among the tools are clamps, wrenches, drills, cutters, and tools for handling cables, connectors, batteries, and screws. N.E.N.

N71-23949*# Massachusetts Inst. of Tech., Cambridge. Charles Stark Draper Lab.

GYRO BEARING IMPROVEMENT PROGRAM, TASKS 1 TO 6 Final Report

Steven Allen Jun. 1970 101 p refs

(Contract NAS9-3079)

(NASA-CR-114980; R-586) Avail: NTIS CSCL 13I

The results are presented of a program to improve the technological base for the manufacture, test, and application of very precise spin-axis ball bearings. The tasks covered include exploration of novel hardening techniques and matching manufacturing techniques on a limited range of stainless steels, as well as bearing surface evaluation techniques. The program final bearings demonstrated the improvements through their excellent geometry and finish. Steel lots of 440C and 440B as well as a 14% Cr, 4% Mo, 1% V martensitic grade were selected on the basis of standard and specially developed inclusion ratings, primary carbide conditions, response to conventional heat treatment, and other quality indices. Variations in conventional heat treatment, and ausforming, strain aging, and a nitriding treatment were investigated, leading to the strengthening of the steel matrices. The manufacturing techniques developed include direct extrusion ausforming, special dimensional control to allow surface hardening, and means for forming bearing rings from fully hardened bar stock. Of the three steels with various hardening treatments, 440C conventionally hardened was found best, with the 14-4-1 ausformed next. Author

N71-24016 National Lending Library for Science and Technology, Boston Spa (England).

SURFACE ROUGHNESS AS CORRECTION FACTOR IN THE INTERFEROMETRIC MEASUREMENT OF THE LENGTH OF BLOCK GAUGES

Martin Duehmke 19 Jan. 1971 5 p Transl. into ENGLISH from Fechber. fuer Oberflachentech. (Brunswick), Nov.–Dec. 1969 p 224–225

(NLL-M-20170-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Two commonly used methods of determining the surface roughness correction are described. In the first method, the length of an auxiliary parallel block gage is determined by interferometric means, the auxiliary gage is wrung onto the specimen, and the overall length is measured interferometrically. This method is subject to errors of two interferometric measurements. The second, or glossimetric method, utilizes the ratio of the diffused part of reflected light to the total reflected light as a measure of the surface roughness for interferometric length measurement, and the scale of the photometer is calibrated only in units of the interferometric roughness correction. The correction values for roughnesses of about 0.01 to 0.07 microns are valid within a few nanometers. N.E.N.

N71-24042* National Aeronautics and Space Administration. Western Operations Office, Santa Monica, Calif.

AUTOMATIC PUMP Patent

Robert E. Wilson, inventor (to NASA) Issued 6 Feb. 1968 (Filed 7 Mar. 1966) 8 p Cl. 103-48

(NASA-Case-XNP-04731; US-Patent-3,367,271; US-Patent-Appl-SN-534966) Avail: US Patent Office CSCL 13K

An automatically reciprocating, high pressure pump that can be employed with cryogenic propellants used in a spacecraft is described. The pump includes two pistons interconnected by a lost motion connection. The first piston does the pumping. The second piston is freely movable relative to the first piston. The second piston covers and uncovers the motive fluid inlet and outlet ports, in response to movement of the first piston. The pump operates automatically and continuously when once started. Official Gazette of the U.S. Patent Office

N71-24043* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.

CONTROLLED RELEASE DEVICE Patent

Terry W. Burcham, inventor (to NASA) Issued 10 Dec. 1968 (Filed 29 Apr. 1966) 4 p Cl. 89-1.806

(NASA-Case-XKS-03338; US-Patent-3,415,156; US-Patent-Appl-SN-547072) Avail: US Patent Office CSCL 13I

A controlled release device for use in launching rockets or missiles is described. It utilizes the expedient of absorbing energy by deforming a ductile elongated pin as it moves through a die. Official Gazette of the U.S. Patent Office

N71-24044* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

HIGH PRESSURE HELIUM PURIFIER Patent

John A. Hauser, inventor (to NASA) Issued 10 Dec. 1968 (Filed 31 Oct. 1966) 5 p Cl. 62-40

(NASA-Case-XMF-06888; US-Patent-3,415,069; US-Patent-Appl-SN-591000) Avail: US Patent Office CSCL 13K

High pressure helium is purified in parallel identical purification units one of which is in operation while the other is being regenerated. Helium is passed through the inner chamber of a heat exchanger having inner and outer chambers wherein the helium is cooled by purified helium passing through a coil in the inner chamber causing moisture and hydrocarbons to be condensed therefrom. The partially purified helium is then passed through a cold trap and an adsorber section including filters both of which are contained within a body of liquid nitrogen to effect removal of the remainder of the impurities. Purified helium then passes through the coil of the inner chamber while nitrogen, vaporized from the body of nitrogen, passes through the outer chamber of the first heat exchanger. Official Gazette of the U.S. Patent Office

N71-24045* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

MECHANICAL ACTUATOR Patent

John C. Johnson, Jr., inventor (to NASA) Issued 12 Aug. 1969 (Filed 2 Oct. 1967) 8 p Cl. 74-100; Int. Cl. F16h21/54, 25/18

(NASA-Case-XGS-04548; US-Patent-3,460,397; US-Patent-Appl-SN-672383) Avail: US Patent Office CSCL 13I

A mechanical actuator is described wherein linear motion is changed to rotational motion. A plunger is rectilinearly moved by a suitable expansion and contraction means. Operably connected to one end of the plunger is a rocking beam attached to a shaft. The shaft rotates in one direction or the other depending upon the position of the rocking beam and the position of the rocking beam is determined by the position of the plunger. In addition, an over center spring system is connected to the rocking beam so that a housing can be rapidly moved from one extreme position to an opposite extreme position.

Official Gazette of the U.S. Patent Office

N71-24046* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

METALLIC FILM DIFFUSION FOR BOUNDARY LUBRICATION Patent

Donald H. Buckley and Robert L. Johnson, inventors (to NASA) Issued 2 Jul. 1968 (Filed 15 Nov. 1966) 3 p Cl. 252-26 Continuation-in-part of US Patent Appl. SN-316477, filed 15 Oct. 1963

(NASA-Case-XLE-10337; US-Patent-3,391,080; US-Patent-Appl-SN-594633) Avail: US Patent Office CSCL 11H

Gallium is diffused into a surface to form a metallic film lubricant. Tin, lead, and indium are added to the gallium to reduce corrosion properties and lower liquid phase temperatures. Official Gazette of the U.S. Patent Office

N71-24047* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

SELECTIVE PLATING OF ETCHED CIRCUITS WITHOUT REMOVING PREVIOUS PLATING Patent

Charles Exum Whitfield, inventor (to NASA) Issued 30 Sep. 1969 (Filed 8 Sep. 1965) 4 p Cl. 156-3; Int. Cl. C23f1/02 (NASA-Case-XGS-03120; US-Patent-3,470,043; US-Patent-Appl-SN-485958) Avail: US Patent Office CSCL 13H

A process is detailed for fabricating an etched copper circuit board wherein discrete portions (conductor paths, terminal pads, etc.) are covered with a suitable metal coating. A resist covered copper board is photographed under a positive film of the conductor paths, developed to bare the conductor path portions of the copper layer, plated with gold on the exposed copper layer, and processed to reprove the resist. The board is again completely coated with resist, photographed under a positive film of the terminal pads, developed to expose only the terminal pads, plated with solder plate on the terminal pads, and processed to remove the resist. The board for a final time is completely covered with resist, photographed under a negative of the overall circuit, developed so that the unprotected copper is etched away, and processed to remove the resist. Official Gazette of the U.S. Patent Office

N71-24048 Lehigh Univ., Bethlehem, Pa.

AN EXPLORATORY STUDY OF FRICTION WELDING

Thomas Paul Rich (Ph.D. Thesis) 1969 344 p

Avail: Univ. Microfilms: HC $15.55/Microfilm $4.40 Order No. 70-10615

Of special interest is the thermal effects upon the zone of plastic material at the weld interface during frictional heating and the ensuing movement of this material during forging. A parameter is developed which relates the upset during forging and a characteristic length of the interfacial plastic zone to a measure of weld quality. This parameter, the interfacial dispersion, is the ratio of the original interfacial area which becomes expelled to the flash during forging to the original area of the abutting weld piece surface. This is postulated to be a measure of the quantity of oxides, voids, and contamination which are forced from the weld juncture into the flash. Thus it presents a potential quantitative measurement of weld quality. Dissert. Abstr.

N71-24078*# National Aeronautics and Space Administration, Washington, D.C.

MACHINE TOOLS AND FIXTURES: A COMPILATION

1970 21 p

(NASA-SP-5910(03)) Avail: NTIS CSCL 13I

Technical information concerning machine tools, and fixtures are presented as part of the Technology Utilization Program. Devices and techniques for cutting, drilling, machining, measuring and aligning materials are included. F.O.S.

N71-24085# Cranfield Inst. of Technology (England).

EFFECT OF WELDING AND POST WELD HEAT TREATMENT ON DUCOL W30

D. Allen, E. Smith, and R. L. Apps Sep. 1970 21 p refs

(MAT-4) Avail: NTIS

Notch toughness, tensile and hardness properties of a normalized and tempered Mn-Cr-Mo-V steel were determined after thermal cycling to 1275 C in simulation of thermal cycles experienced in the coarse grained region of the heat affected zone (HAZ). Post-weld heat treatments for 100 min. in the range 450-650 C resulted in decreased notch toughness of the coarse grained HAZ with maximum embrittlement after heat treatment at 550 C and 600 C. Heat treatment for 100 min. at 675 C was necessary to overcome this embrittling effect. A brief examination was made of HAZ structures produced in multipass welds by subjecting specimens to double weld thermal cycles. A second thermal cycle to a peak temperature of 765 C on a specimen initially cycled to produce a coarse grained HAZ structure resulted in areas of martensite at the prior austenite grain boundaries with a slight decrease in notch toughness. Tensile tests at 365 C were also conducted on the parent plate and some of the thermally cycled specimens. The greatest decreases in proof stress and tensile strength at 365 C were 11% and 16% respectively for the parent plate. Author

N71-24132 Rensselaer Polytechnic Inst., Troy, N.Y.

A GENERAL METHOD FOR THE KINEMATIC SYNTHESIS AND FORCE BALANCING OF SPATIAL MECHANISMS

Roger Emanuel Kaufman (Ph.D. Thesis) 1969 308 p

Avail: Univ. Microfilms: HC $13.95/Microfilm $3.95 Order No. 70-11322

A class of spatial six-link mechanisms is introduced having the property that one coupler link moves with no constrained sphere points relative to the ground link. As a result, these mechanisms are capable of producing very general forms of spatial motion. Combinatorial analysis was used to predict the number of possible mechanisms of this type. The method of synthesizing this mechanism for spatial motion generation through the maximum possible number of prescribed precision positions is outlined. In addition, a class of geared spatial mechanisms is introduced, and a spatial geared five-link mechanism is synthesized in closed-form for use as a function generator with skew input and output shafts. A method for completely force balancing spatial linkages is developed. To illustrate the method of applying this theory an RSSR mechanism and a spatial slider-crank mechanism are force-balanced. Dissert. Abstr.

N71-24144# Brown (John A.), Berkeley Heights, N.J.

A STUDY OF FRICTION FUNDAMENTALS IN EXPLOSIVES Final Technical Report

John A. Brown Dec. 1970 85 p refs

(Contract DAAA21-69-C-0558)

(AD-718086) Avail: NTIS CSCL 19/1

Mechanical and lubrication engineers picture solid-solid contact as taking place only on the tips of the higher asperities of each surface, so that the contact load is borne only on a very small portion of the total surface area and all frictional heat is generated and absorbed in this small area. The size and number of the individual asperity junctions is in general not known; but averages are known, and it appears that asperity heights and spatial frequencies are described reasonably well by Gaussian statistics. This should make it possible to calculate frictional hot-spot temperatures and distributions on an explosive surface, given some laboratory measurements of factors such as coefficients of friction, frictional work expended and surface characteristics. With hot-spot statistics available, the probability of explosion can be calculated by available, published methods. A coordinated theoretical and empirical research program is proposed to apply the above engineering and mathematical concepts to explosives. The results should facilitate the identification of basic mechanical processes (such as metal-metal friction, or the viscous or plastic shear of explosives) which do and do not generate explosion hazards. This in turn will aid the design of more valid laboratory friction sensitivity testers and the design of safer explosive processing plants. Author (GRA)

N71-24164* Schjeldahl (G. T.) Co., Northfield, Minn.

TRAVELING SEALER FOR CONTOURED TABLE Patent

Austin D. McHatton, Bert C. Deis, Sigvard Stenlund, and Richard J. Slater, inventors (to NASA) Issued 17 Dec. 1968 (Filed 20 Oct. 1965) 9 p Cl. 156-545 Sponsored by NASA (NASA-Case-XLA-01494; US-Patent-3,416,988; US-Patent-Appl-SN-499122) Avail: US Patent Office CSCL 13I

A sealing apparatus for joining two pieces of frangible material is described for lightweight, airtight seals. One edge is supported outstretched and another is carried on a roll mounted on a carriage which travels along the outstretched edge. The sealer is mounted on the carriage to travel along and seal the two edges. F.O.S.

N71-24171*# National Aeronautics and Space Administration, Washington, D.C.
MATERIAL CUTTING, SHAPING, AND FORMING: A COMPILATION
1970 24 p refs
(NASA-SP-5922(01)) Avail: NTIS CSCL 13H

Technical information on the industrial application of metal working methods is presented. Subjects discussed are: (1) cutting, (2) shaping, (3) forming, and (4) miscellaneous fabrication of a variety of materials. The document is a part of a series of documents in the NASA Technology Utilization Program. Author

N71-24180*# General Electric Co., Daytona Beach, Fla. Space Div.
STUDY OF AEROSPACE STRUCTURAL MANUFACTURING CONCEPTS. VOLUME 1: SUMMARY Final Report
15 Mar. 1971 32 p refs
(Contract NAS2-5857)
(NASA-CR-114281) Avail: NTIS CSCL 13H

The results of a study of aerospace manufacturing concepts are summarized. Detailed manfacturing line definitions are established for two production rates (2 per year and 20 per year) for each of three manufacturing lines spanning state-of-the-art and improved and advanced manufacturing technologies. A computerized simulation model (MANCAN) was used for accumulating costs for assessing the impact of variations and interactions of factors on manufacturing cost. Cost distributions for the nominal cases show the predominant importance of facilities and tooling on manufacturing costs. Facilities and tooling costs ranged from 42 percent to 81.2 percent of the total, far outshadowing recurring costs such as materials and labor. The largest potential area for cost reductions lies in those factors which reduce facility and tooling expense. The impact of the facility and tooling costs on the unit production costs are illustrated showing the marked decrease if these costs are written off against increased quantity. Coupling high quantity production with advantageous factors reduces unit production costs by approximately two orders of magnitude. Technology developments aimed at reducing future aerospace structural manufacturing costs can be focused best on simple, rugged structures that can be produced in quantity in inexpensive facilities. Author

N71-24181*# General Electric Co., Daytona Beach, Fla. Space Div.
STUDY OF AEROSPACE STRUCTURAL MANUFACTURING CONCEPTS. VOLUME 2: MANUFACTURING LINE MODEL DESCRIPTIONS, ANALYSES, AND RESULTS Final Report
15 Mar. 1971 216 p refs
(Contract NAS2-5857)
(NASA-CR-114282) Avail: NTIS CSCL 13H

The economic examination is presented of the technology areas pertinent to conventional (aluminum) aerospace manufacturing. Two representative structures are used in a systems analysis of the impact of technology and program factors on manufacturing. The initial manufacturing lines are defined using today's state-of-the-art procedures and costs. Facilities, tooling, premanufacturing operations, materials, manufacturing and quality control labor are indicated. Improvements in overall operations and manufacturing technology are introduced to define improved and advanced manufacturing lines. A computer model was developed for accumulating and manipulating manufacturing data and costs and is described in detail. Information related to the manufacturing technologies has been derived primarily from Government and industry sources typified by Saturn/Apollo structural manufacturing experience. Results for representative structures indicate that the recurring part of the manufacturing processes cost is not the major portion of the total manufacturing cost. In general it was shown that for the manufacture of a propellant tank the facilities, tooling and other nonrecurring costs represent from one-half to three-fourths of the total manufacturing cost. No single factor has a more significant impact on cost than the quantity of like elements produced. Author

N71-24182*# General Electric Co., Daytona Beach, Fla. Space Div.
STUDY OF AEROSPACE STRUCTURAL MANUFACTURING CONCEPTS. VOLUME 3: SURVEY OF MANUFACTURING TECHNIQUES AND FACTORS Final Report
15 Mar. 1971 395 p refs
(Contract NAS2-5857)
(NASA-CR-114283) Avail: NTIS HC $6.00/MF $0.95 CSCL 13H

The results of a survey of manufacturing techniques are presented as the initial part of the study of aerospace structural manufacturing concepts. The work performed is devoted primarily to examination of the technology areas pertinent to conventional (aluminum) aerospace manufacturing and to the impact of factors on the technology areas. Specific observations as well as the qualitative impact of factors on manufacturing are also reviewed. Factors and plant facilities influencing these technologies were identified from reviewing these areas with aerospace contractors as well as from internal manufacturing consultants. Interrelationships between these areas are illustrated. The five major areas of investigation and primary sources of data in these areas are summarized. Information related to the manufacturing technologies was derived primarily from Government and industry sources typified by Saturn/Apollo structural manufacturing experience. Author

N71-24228 National Lending Library for Science and Technology, Boston Spa (England).
MEASURING THE DIAMETER OF A CYLINDER BY INTERFEROMETRIC MEANS
M. Duehmke 19 Jan. 1971 5 p Transl. into ENGLISH from PTB Mitt. (West Ger.), no. 6, 1969 p 438–440
(NLL-M-20171-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

In the context of comparative measurements between several national institutes, the diameter of a pressure cylinder of molybdenum-carbide was measured. The measurement was taken at a specific point; determined by the height along the cylinder envelope and also the angle along the circumference. Using amplifying interferometer and narrow multiple beam band, observations of the elliptical interference lines on the cylinder envelope were made in the vicinity of the uppermost envelope line. Author

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N71-23104# Joint Publications Research Service, Washington, D.C.
HIGH ENERGY PHYSICS

20 Apr. 1971 16 p refs Transl. into ENGLISH from Fiz. Khim. Obrab. Mater. (Moscow), No. 1, 1967 p 27–32; No. 5, 1967 p 11–14
(JPRS-52916) Avail: NTIS

CONTENTS:

1. HEATING MATERIALS BY RADIATION FROM AN OPTICAL QUANTUM GENERATOR V. P. Veyko et al p 1–9 refs (See N71-23105 12-16)

2. TEMPERATURE FIELD IN MEDIA WITH ABSORPTION DURING ACTION OF LOCAL HEAT N. N. Rykalin et al p 10–15 refs (See N71-23106 12-16)

N71-23105# Joint Publications Research Service, Washington, D.C.

HEATING MATERIALS BY RADIATION FROM AN OPTICAL QUANTUM GENERATOR

V. P. Veyko et al *In its* High Energy Phys. 20 Apr. 1971 p 1–9 refs (See N71-23104 12-16)
Avail: NTIS

The nonstationary problem of heat conductance in ferrite resulting from absorption of pulsed laser radiation is discussed for the case preceding thermal breakdown. Quantitative expressions are developed for the relation between the radiation flux and the pulse duration. This yields estimations of the time of heating the surface to boiling, depth of heated layer, and effect of temporary pulse structure on the material heating which are in good agreement with experimental values. N.E.N.

N71-23106# Joint Publications Research Service, Washington, D.C.

TEMPERATURE FIELD IN MEDIA WITH ABSORPTION DURING ACTION OF LOCAL HEAT

N. N. Rykalin et al *In its* High Energy Phys. 20 Apr. 1971 p 10–15 refs (See N71-23104 12-16)
Avail: NTIS

The heating by laser beam absorption of metallic solids which have an absorption depth comparable with the radius of the heating spot are is discussed. In a first approximation, absorption is described by the Bouguer law. The parameters on which the temperature field is dependent include proximity of source, volumetric or surface nature of the source, radius of the heated spot, radiation intensity and radial intensity distribution, and absorptivity of the metals or alloys. N.E.N.

N71-23298# University of Southern Calif., Los Angeles. Electronic Sciences Lab.

INSTABILITIES IN LASER PROPAGATION IN FLUIDS Final Report, 1 Aug. 1968–31 Oct. 1970

William G. Wagner Oct. 1970 196 p refs
(Contract N00014-67-A-0269-0006; ARPA Order 306-62)
(AD-718858; USCEE-400) Avail: NTIS CSCL 20/5

Instabilities in the system of equations describing electromagnetic wave propagation and fluid dynamics are discussed The basic equations are discussed, and the linearized stability analysis is presented along with an evaluation of the threshold for these growing waves. To follow the growth of the disturbances, computer studies were undertaken. In the course of these studies it became apparent that there was some merit to introducing a new concept to judge the value of an algorithm for computing the solutions of a system of partial differential equations. This concept was called utility, and is discussed along with several examples of its application to simpler partial differential equations. Presented are the results of a calculation of beam distortion for a very high intensity pulse propagating through air for several kilometers. In the attempt to calculate distortions of the type predicted by the linearized instability analysis, cylindrical symmetry was imposed on the problem in order to facilitate the computer calculation. The report contains an analytic discussion of beam bending and thermal blooming for a slab beam propagating through a wind. A formula is derived which provides for the transition between two regimes in which conduction and forced convection, respectively, dominate the dissipation of heat deposited in the medium from the laser beam. Author (GRA)

N71-23319# Systems Science and Software, La Jolla, Calif.

ENERGY DEPOSITION IN LASERS Bimonthly Technical Report, 1 Dec. 1970–31 Jan. 1971

Marius Troost and C. W. Hartley 31 Jan. 1971 5 p
(Contract N00014-70-C-0341; ARPA Order 660)
(AD-718802) Avail: NTIS CSCL 20/5

The contract has been continued to provide an improved version of the ZAP code. The following items have been added to the code: multi-frequency calculation, bodies of revolution, cylindrical surface source, and geometry debug facility. The addition of a helix geometry has been partially completed. Author (GRA)

N71-23320# Naval Ordnance Lab., White Oak, Md.

NUMERICAL EXPERIMENTS ASSOCIATED WITH GAS DYNAMIC LASERS

John D. Anderson, Jr. 24 Oct. 1970 73 p refs
(AD-718805; NOLTR-70-198) Avail: NTIS CSCL 20/5

A previous time-dependent finite-difference numerical solution of second order accuracy for quasi-one-dimensional nonequilibrium nozzle flows using 3 terms of a Taylors series expansion in time is modified such that only 2 terms of a series expansion are required for second order accuracy. As a result, an already straightforward analysis of nonequilibrium nozzle flows is made even simpler. With the present solution, numerical experiments are carried out for gas dynamic laser flows in order to study the consequences of large H_2O content, high reservoir pressures and small nozzle throat heights. Author (GRA)

N71-23324# Teledyne Brown Engineering, Huntsville, Ala. Science and Engineering Div.

APPLICATIONS OF LASER DOPPLER TECHNIQUES FOR MEASUREMENTS IN LARGE FLOW SYSTEMS

Tex D. Lewis and Neil E. Chatterton Nov. 1970 195 p refs
(Contract N00014-70-C-0060)
(AD-718818; SE-301) Avail: NTIS CSCL 20/4

The objective of the study was to develop the theoretical and experimental knowledge necessary to utilize the laser Doppler velocity measurement technique in large flow systems. Theoretical treatments were developed to allow prediction of the capabilities and limitations of the laser Doppler technique as applied to (1) use in the backscatter mode with no artificial contaminants in the flow; (2) localization of the measurement volume and its effects on the measurement of turbulence phenomena; and (3) degradation of the heterodyning efficiency due to long path lengths in optically inhomogeneous media. Experimental confirmation of theoretical predictions were carried out to demonstrate validity or to establish an experimental technique. Author (GRA)

N71-23325# Illinois Univ., Urbana. Dept. of Electrical Engineering.

MOLECULAR LASER STUDIES IN THE FAR INFRARED Final Technical Report, 1 Oct. 1969–30 Sep. 1970

Paul D. Coleman 30 Sep. 1970 111 p refs
(Grant AF-AFOSR-1147-68B)
(AD-718160; AFOSR-70-2922TR) Avail: NTIS CSCL 20/5

The report is a summary report of investigations on molecular lasers in the far infrared (25-1000 microns). Lasers studied were H_2O, SO_2, and H_2S. Problems investigated are the assignment of

levels for the laser transitions and extricating the details of the excitation mechanisms and relaxation. This understanding is needed to optimize the power output and efficiency of the molecular lasers. A new excitation method investigated was that of Franck-Condon pumping. Author (GRA)

N71-23384*# Scripta Technica, Inc., Washington, D.C.
AN INVESTIGATION OF THE EVAPORATION PROCESSES OF A SUBSTANCE AND PLASMA DEVELOPMENT WHEN LASER RADIATION STRIKES DIFFERENT MATERIALS [ISSLEDOVANIYE PROTSESSOV ISPARENIYA VESHCHESTVA I RAZVITIYA PLAZMY PRI VOZDEYSTVII IZLUCHENIYA OPTICHESKOGO KVANTOVOGO GENERATORA NA RAZLICHNYYE MATERIALY]
M. V. Akhmanova et al NASA Apr. 1971 8 p refs Transl. into ENGLISH from Zh. Prikl. Spektroscopii, Akad. Nauk Belorussk. SSR (Minsk), v. 8, no. 4, Apr. 1968 p 584–587
(Contract NASw-2036)
(NASA-TT-F-13539) Avail: NTIS CSCL 20E

Experimental and calculated values of the amount of material evaporated and of the initial escape velocity of the evaporation products were found to agree reasonably well, except in those cases when fragments of the specimen are also produced by the action of the laser beam. Specimens of metals, ionic crystals, semiconductors, organic substances and natural inorganic materials were chosen as the test objects. A type GSI-1 neodymium-glass laser was used (lambda = 1.06 micrometer, 20 J radiation energy, pulse duration approximately 500 microsecond). The experiments were conducted in air at normal pressure. An SKS-1m motion-picture camera and an SFR-2m high-speed photorecorder were used to record the processes as a function of time. A MIN-5 microscope was used to obtain microphotographs of the radiation-damaged areas. The amount of substance ejected was determined by weighing the specimen before and after bombardment with laser radiation. The portion evaporated was found from the difference between the total amount of ejected material and those fragments (blobs) which appeared around the damaged target. Author

N71-23404# Utah Univ., Salt Lake City.
MICROWAVE DEVICE AND PHYSICAL ELECTRONICS LABORATORY Consolidated Quarterly Report, 1 Apr.–30 Jun. 1970
R. L. Arnold, J. M. Baird, N. E. Buholz, L. Campbell, and P. W. Chen 30 Jun. 1970 111 p refs
(Contracts F44620-68-C-0022; N00014-69-C-0345)
(AD-717970; MDL-Q33; UTEC-MD-70-188) Avail: NTIS CSCL 20/5

Contents: Optical frequency tuning by parametric operation; Carbon dioxide laser; Tunable raman effect in crystals; Ring laser studies; An impedance analysis of double-stream interaction in semiconductors; Double-stream interaction under crossed electric and magnetic fields in semiconductors; Measurement of chamber temperature by microwave techniques; Investigation of techniques for using microwaves to measure cracks or voids in solid propellants. GRA

N71-23621# Stanford Univ., Calif. Microwave Lab.
METHODS FOR OBTAINING LASER ACTION AT WAVELENGTHS SHORTER THAN 3000A Semiannual Status Report, 1 Mar.–31 Aug. 1970
R. H. Pantell Sep. 1970 11 p refs
(Contract N00014-67-A-0112-0033)
(AD-718469; ML-1884; SASR-3) Avail: NTIS CSCL 20/5

The general objective of this research program is to investigate a method for achieving laser action at wavelengths less than 3000A. The theory and calculations presented in this report constitute the basis for the design and construction of a new type of laser device, an electron-pumped Cerenkov laser. Preliminary theoretical and experimental work indicate that such a device is feasible. Author (GRA)

N71-23622# Ohio State Univ. Research Foundation, Columbus.
STUDY OF OPTICAL MASERS Final Report, 1 Apr. 1967–31 Dec. 1970
C. V. Heer 10 Feb. 1970 16 p
(Grant DA-AROD-31-124-G814)
(AD-718780; AROD-6922.11P; FR-11) Avail: NTIS CSCL 20/5

Research topics have been anomalous polarization in lasers and in amplifying media, photon rate gyroscope or ring laser, ultraviolet lasers, measurement of motion in space, and adsorption isotherms for monolayer coverage on laboratory surfaces. This report provides a brief summary and lists publications. Author (GRA)

N71-23704# Michigan Univ., Ann Arbor. Inst. of Science and Technology.
INVESTIGATION OF HOLOGRAPHIC TESTING TECHNIQUES Semiannual Report, 1 Jun.–27 Nov. 1970
Emmett N. Leith and Charles M. Vest Feb. 1971 75 p refs
(Contract DAAG46-69-C-0017; ARPA Order 1245)
(AD-718386; Rept-2420-21-P; SAR-4) Avail: NTIS CSCL 14/2

The report discusses holographic schemes for the detection of flaws in honeycomb panels and also describes the development of a method of reducing the sensitivity of holographic interferometry of transparent objects. An interferometric scheme for determining the surface roughness of flat objects is presented, and a planned application of the technique to curved objects is discussed. Recent advances in multiple-frequency holographic contouring are described, and a comparison of holographic and shadow-moire contouring schemes is presented. A computer simulation of acoustical holography and its use for reduction of aberration are also discussed. Author (GRA)

N71-23706# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
INVESTIGATION OF A PLATINUM CATALYZED CO2 LASER
Pau. J. Monaghan, Jr. Oct. 1970 46 p refs
(AD-718424; ASD-TDR-70-23) Avail: NTIS CSCL 20/5

In any type of a gas discharge, dissociative products reduce gaseous reactant concentrations resulting in cessation of the desired reaction. In a CO2 laser, dissociation of the CO2 molecule results in increased concentrations of CO and O2 while reducing the CO2 concentration. As the CO2 concentration decreases so does power output of the device. From a purely chemical standpoint, the process of dissociating CO2 in an electrical discharge should be completely reversible, i.e., $2CO_2 = 2CO + O_2 + E$, where E represents the exothermic energy of dissociation. The research reported was directed towards determining if the reaction could be reversed by employing an internal catalyst. Previous correlations between increased laser output and platinum elements within the plasma were shown to be misleading. Author (GRA)

N71-23719# Lockheed Missiles and Space Co., Palo Alto, Calif.
LASERS AND CONTROLLED THERMONUCLEAR FUSION
N. G. Basov et al 1971 14 p refs Transl. into ENGLISH from Priroda (USSR), No. 1, 1971 p 7–15
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Theoretical thermonuclear reactions of interest in pulsed laser uses are reviewed, and results of laser experiments are given. The laser apparatus and the effects of beam irradiation on an LiD target are described. Possible efficiency and applications of lasers to control thermonuclear fusion are also outlined. N.E.N.

N71-23791*# Scripta Technica, Inc., Washington, D.C.
STUDIES OF THE TIME DEPENDENCE OF THE VAPOR LUMINESCENCE PROCESS FOR A COMBINED METHOD OF EXCITATION [VREMENNYYE ISSLEDOVANIYA PROTESSA VYSVECHINVANIYA PAROV PRI KOMBINIROVANNOM SPOSOBE VOZBUZHDENIYA]
A. V. Karyakin et al NASA Apr. 1971 14 p refs Transl. into ENGLISH from Zh. Prikl. Pektroscopii, Akad. Nauk Belorussk. SSR (Minsk), v. 8, no. 3, Mar. 1968 p 433-438
(Contract NASw-2036)
(NASA-TT-F-13540) Avail: NTIS CSCL 20E

A time-scan method of spectral analysis is described. The method permits the selection of the most favorable ratio between line and background intensities and the phase of spectrum development during which self-reversal is absent. Author

N71-23800# Stanford Univ., Calif. Microwave Lab.
METHODS FOR OBTAINING LASER ACTION AT WAVELENGTHS SHORTER THAN 3000 A Semiannual Status Report, 1 Sep. 1969 - 28 Feb. 1970
R. H. Pantell Mar. 1970 12 p refs
(Contract N00014-67-A-0112-0033)
(AD-718468; ML-1843; SASR-2) Avail: NTIS CSCL 20/5

The general objective of this research program is to investigate methods for achieving laser action at wavelengths less than 3000 A. Two techniques are investigated which are applicable to short wavelength laser action. The first is two-step laser action. The second is a tunable Cerenkov laser. These research projects are described. Author (GRA)

N71-23801# Northrop Corporate Labs., Hawthorne, Calif. Electromagnetics Lab.
CARBON MONOXIDE LASER Semiannual Technical Report, 1 Aug. 1970 - 31 Jan. 1971
M. L. Bhaumik 31 Jan. 1971 6 p
(Contract N00014-71-C-0037; ARPA Order 306)
(AD-718443; NCL-71-8R) Avail: NTIS CSCL 20/5

The small signal gain coefficient and spectral characteristics of an electrically excited room-temperature CO laser were investigated for the purpose of understanding the role of the necessary gas constituents and the possible excitation mechanisms are discussed. Author (GRA)

N71-23819# Utah Univ., Salt Lake City. Microwave Device and Physical Electronics Lab.
QUANTUM, SOLID STATE, AND PLASMA DIAGNOSTIC STUDIES Consolidated Quarterly Report, 1 Jan. - 31 Mar. 1970
R. L. Arnold, J. M. Baird, N. E. Buholz, L. Campbell, P. W. Chen et al 31 Mar. 1970 113 p refs
(Contracts F44620-68-C-0022; N00014-69-C-0345)
(AD-717971; MDL-Q32; UTEC-MD-70-159) Avail: NTIS CSCL 20/5

Contents: Optical frequency turning by parametric operation; Carbon dioxide laser; Tunable Raman effect in crystals; fling laser studies; An impedance analysis of double-stream interaction in semiconductors; Double-stream interaction under crossed electric and magnetic fields in semiconductors; Measurement of chamber temperature by microwave techniques; investigation of techniques for using microwaves to measure cracks or voids in solid propellants. GRA

N71-24011# Stanford Univ., Calif. Inst. for Plasma Research.
RATE COEFFICIENTS FOR VIBRATIONAL ENERGY TRANSFER IN RAPID EXPANSIONS OF CARBON DIOXIDE-NITROGEN MIXTURES
John R. MacDonald Dec. 1970 202 p refs
(Contract F44620-68-C-0051)
(AD-718131; SU-IPR-394; AFOSR-TR-71-0191) Avail: NTIS CSCL 7/4

An investigation of vibrational energy transfer processes in a rapid expansion containing N2, CO2, and Ar is presented along with related analyses. In the experiment, arc-heated Ar was mixed with N2 and CO2 and a rapid expansion was obtained by expanding the gas mixture in an underexpanded free jet. The stagnation temperature was varied from 1900K to 2900K and the stagnation pressure was held near 2.7 atm. Particular emphasis was placed on ensuring gas purity and the test gas was analyzed to obtain quantitative measurements of gas purity. The vibrational temperatures of N2 and CO2 (V3) were determined from spatially-resolved spectroscopic measurements. In addition, information was obtained about the CO2(V3 + 3V2) intramolecular and the CO2 V-T processes in the rapid expansion. The results show that the rate coefficients needed to match the theory to the data generally exceed those measured in shock-heating and laser-fluorescence experiments. The importance of these measurements with regard to prediction of CO2-N2 gas dynamic laser performance is also discussed. Author (GRA)

N71-24058*# Scripta Technica, Inc., Washington, D.C.
THE SENSITIVITY OF EMISSION SPECTRAL ANALYSIS USING A LASER [O CHUVSTVITELNOSTI EMISSIONNOGO SPEKTRALNOGO ANALIZA S PRIMENENIYEM OKG]
B. V. Pateleev et al NASA Apr. 1971 8 p refs Transl. into ENGLISH from Zh. Prikl. Pektroskoppii, Akad. Nauk Belorussk. SSR (Minsk), v. 12, no. 6, 1970 p 1106-1108
(Contract NASw-2036)
(NASA-TT-F-13542) Avail: NTIS CSCL 20E

Experiments were performed on the spectral analysis sensitivity (both absolute and relative) when a laser is used as the excitation source. A variety of substances, including granite, chalk and various metals, were examined with the laser operating in the free-running and giant-pulse modes. The results of a preliminary evaluation study of the sensitivity are presented. Author

N71-24068# Kentucky Univ., Lexington. Dept. of Electrical Engineering.
SLIT FUNCTIONS CORRECTIONS APPLIED TO LASER EXCITED RAMAN BANDS OF LIQUIDS
In its A Laser Raman Study of Two Halides of Sulfur Apr. 1971 p 26-34 refs (See N71-24062 12-06)
Avail: Issuing Activity

The use of small spectral slit widths complicates Raman intensity measurements of laser excited spectra. The nature of the slit-function correction in medium resolution laser Raman instruments is discussed and some effects of asymmetric slit functions on asymmetric and symmetric Raman bands are explored. Corrections for non-idealized slit functions are applied to the contours of the Raman bands of CCl4 at 458/cm and CH3OH at 1028/cm. Author

N71-24074* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
METHOD FOR MEASURING THE CHARACTERISTICS OF A GAS Patent
Stuart L. Seaton, inventor (to NASA) Issued 27 May 1969 (Filed 8 Dec. 1965) 6 p Cl. 356-104; Int. Cl. G01n21/26
(NASA-Case-XLA-03375; US-Patent-3,446,558; US-Patent-Appl-SN-512562) Avail: US Patent Office CSCL 20E

A device to aid in simultaneously determining the density, velocity and temperature of a streaming gas is described. The beams of first and second lasers, having different frequencies, are directed into a small region of the streaming gas. A receiver is aimed at the small region of the gas for receiving the difference

frequency scattered by the particles in the gas and producing an electrical signal therefrom. Means are connected to the output of the receiver for recording the magnitude, frequency and spectral distribution of the electrical signal. From these recordings, the recordings of the magnitudes of the beams of the first and second lasers, and the calibrations of the first and second lasers, the density, velocity and temperature of the streaming gas can be determined. Official Gazette of the U.S. Patent Office

N71-24076# Aeronautical Research Labs., Melbourne (Australia).
TIME SAMPLED ACOUSTIC HOLOGRAPHY
A. J. Farrell Feb. 1970 25 p refs
(ARL/Inst-73) Avail: NTIS

A new method of forming mechanically scanned acoustic holograms which eliminates the requirement for a reference wave is proposed. Electronic circuits capable of performing the necessary signal processing are shown and their operation described. It is concluded that the simplifications introduced by the new method justify an experimental investigation of the proposal. Author

N71-24081*# Wayne State Univ., Detroit, Mich. Research Inst. for Engineering Sciences.
STUDY OF CONCEPTUAL AND OPERATIONAL FEASIBILITY OF LASER DOPPLER DETECTION SYSTEMS Progress Report
J. Alex Thomson 30 Nov. 1970 103 p refs
(Contract NAS8-24810)
(NASA-CR-103105) Avail: NTIS CSCL 20E

Continuing research is reported in a program aimed at establishing the feasibility and design criteria of a laser doppler system for detecting and mapping turbulence levels and wind or velocity profiles in various applications. Current efforts include: (1) the design of an optical mechanical system for the laser van; (2) calculations to obtain detailed profiles for the system radial and axial response for various operating conditions and methods, and aperture apodization functions; (3) compilation of a set of specific experiments and experimental objectives for the laser van system; and (4) construction of a source that can be used as a standard scatterer. A summary of completed projects is included. D.L.G.

N71-24166*# Massachusetts Inst. of Tech., Cambridge. Materials Theory Group.
THE BEHAVIOR OF LASER MODES IN A MEDIUM WITH TIME VARYING DIELECTRIC CONSTANT
Colin Gordon Whitney (Ph.D. Thesis) 25 Aug. 1970 170 p refs Sponsored in part by NASA
(Contract DA-31-124-ARO(D)-92; ARPA SD-90)
(NASA-CR-118038; TR-9) Avail: NTIS CSCL 20E

The effect, on semiconductor laser modes, of a time-varying modulation of the complex dielectric constant of the active region of the laser, is considered. It is seen that the main effect is to produce frequency modulation associated with modulation of the real part of the dielectric constant while modulation of the imaginary part gives rise to amplitude modulation. Two methods for producing the modulation are considered. The first, pressure via ultrasonic waves, produces pure frequency modulation in impure material. The second, modulation of the injection, results in both amplitude and frequency modulation. Experiments to confirm this analysis were carried out on a cw GaAs injection laser. The modulated laser spectrum was observed with a Fabry-Perot interferometer. Pressure modulation was seen to give frequency modulation with little distortion, while for injection modulation, ratio of the amplitude modulation index to frequency modulation index was found to be about 0.1. High resolution measurements on the pulsed spectral shift of a GaAs laser at 77 K and 4.2 K were performed using a Fabry-Perot interferometer. The feasibility of detecting modulation on a pulsed semiconductor laser was demonstrated. Author

N71-24170* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LASER GRATING INTERFEROMETER Patent
James R. Sterrett, James C. Emery, and John B. Barber, inventors (to NASA) Issued 23 Sep. 1969 (Filed 26 Apr. 1966) 5 p Cl. 356-107; Int. Cl. G01b9/02; Int. Cl. G01n21/48
(NASA-Case-XLA-04295; US-Patent-3,468,609; US-Patent-Appl-SN-546149) Avail: US Patent Office CSCL 20E

The design and development of a laser grating interferometer which employs a laser as the light source is presented. The interferometer employs a continuous wave gas laser light source, with diversion light from the laser source being collected by a mirror. The mirror reflects the light to a second mirror which refocuses the light waves onto a diffraction grating placed near the image of the light source. The diffraction grating breaks the light beam into a series of detectable diffracted beams or orders. Official Gazette of the U.S. Patent Office

N71-24195# Owens-Illinois, Inc., Toledo, Ohio. Consumer and Technical Products Div.
DAMAGE THRESHOLD STUDIES OF GLASS LASER MATERIALS Semiannual Technical Report, 1 Jul.–31 Dec. 1970
N. L. Boling, L. Spanoudis, and P. R. Wengert 31 Jan. 1971 70 p refs
(Contract DAHC15-69-C-0303; ARPA Order 1441)
(AD-718896) Avail: NTIS CSCL 20/5

The work has two aspects: (1) an investigation of elimination of damaging platinum particles from laser glass melted in platinum crucibles, and (2) a study of the causes and prevention of surface damage to laser glass exposed to high intensity laser pulses. Work performed on the former aspect has involved a theoretical investigation, based upon a literature search, of activity coefficients. The goal of this is determination of partial pressures of oxygen in the melting environment which will prevent formation of damaging platinum particles and at the same time prevent crucible attack. The surface damage study involves a search for causes of damage through high speed holography. Further, chemical treatments of glass surfaces are being explored as a means of increasing the damage threshold. Work on this surface damage phase has primarily involved design and modification of experimental equipment. Author (GRA)

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N71-23101*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OXIDATION OF Ni-20Cr-2ThO2 AND Ni-20Cr-1.5Si AT 800, 1000, AND 1200 C
Carl E. Lowell, Daniel L. Deadmore, Salvatore J. Grisaffe, and Isadore L. Dreil Washington Apr. 1971 29 p refs
(NASA-TN-D-6290; E-5751) Avail: NTIS CSCL 11F

High-temperature X-ray diffraction, weight- and thickness-change measurements, and electron-mircoprobe analysis were combined to study oxidation of Ni-20Cr-2ThO2(TD-NiCr) and Ni-30Cr-1.5Si (Tophet-30) in static air for 100 hours. Oxidation after grinding the surface of TD-NiCr gave Cr_2O_3 scale, while oxidation after polishing gave a scale of NiO, $NiCr_2O_4$, and Cr_2O_3. Cr_2O_3 was lost by vaporization from both scales extensively, but the polished material was somewhat more oxidation resistant. After

either surface preparation, Tophet-30 formed a Cr2O3 scale which seemed more resistant to vaporization loss than the Cr2O3 on TD-NiCr. Metal-thickness losses were similar in both alloys. Author

N71-23109# California Univ., Livermore. Lawrence Radiation Lab.

DISPERSION HARDENING OF A MO-1 ATOMIC WEIGHT PERCENT Hf ALLOY BY INTERNAL HARDENING

L. Himmel and J. B. Mitchell 19 Aug. 1970 7 p refs Presented at the 2nd Intern. Conf. on the Strength of Metals and Alloys, Pacific Grove, Calif., 30 Aug.–4 Sep. 1970 Submitted for publication Sponsored by AEC

(UCRL-72627; CONF-700819-9) Avail: NTIS

The microstructure and high-temperature tensile properties of an internally nitrided Mo–1 at. % Hf alloy were studied. The strength levels, though not optimum, were far superior to those of the best commercial high-strength TZM and TZC Mo-base alloys. NSA

N71-23110*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EFFECT OF GRAIN SIZE ON CREEP PROPERTIES OF A TUNGSTEN 25-ATOMIC-PERCENT-RHENIUM 30-ATOMIC-PERCENT-MOLYBDENUM ALLOY FROM 1800-4000 F (982-2204 C)

Robert J. Buzzard Washington Apr. 1971 27 p refs

(NASA-TN-D-6285; E-5792) Avail: NTIS CSCL 11F

The stress to achieve one percent total creep strain at temperatures of 1800 F to 4000 F was determined for powder metallurgy W-25 at % Re-30 at % Mo sheet. Grain sizes of 0.0014 and 0.0025 cm and a duplex structure of 0.0028 to 0.063 cm, resulted from 2-hr anneals at 2900 F, 3600 F, and 4000 F, respectively. For each annealing treatment, room temperature bend ductility also was determined. The 0.0025-cm grain size material offered the best creep resistance of the three at low temperatures (below 2400 F) and high stresses (4 ksi and above) and was ductile at room temperature. Author

N71-23114*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CREEP BEHAVIOR OF ELECTRON-BEAM-MELTED RHENIUM

Walter R. Witzke and Peter L. Raffo Washington Apr. 1971 24 p refs

(NASA-TN-D-6291; E-6073) Avail: NTIS CSCL 11F

Creep deformation in electron beam-melted polycrystalline rhenium sheet was evaluated at 2200 to 4200 F (1477 to 2588 K) and 4 to 40 ksi (28 to 276 MN/sq m). Comparisons were made with powder-metallurgy rhenium under similar conditions. Changes in creep rupture behavior resulting from electron beam melting of rhenium were greater ductility, higher primary creep rate, and longer rupture life, especially at lower temperatures. The activation energy for creep was 72 kcal/mole (301 J/mole) for electron beam-melted rhenium and 64 kcal/mole (268 J/mole) for powder-metallurgy rhenium. Author

N71-23136*# Little (Arthur D.), Inc., Cambridge, Mass.

APPLICATION OF YTTRIUM COATINGS ON CHROMIUM-BASE ALLOYS BY METALLIDING Final Report

Joan Berkowitz-Mattuck, George Feick, John O'Brien, and Francis Galligani 31 Mar. 1971 56 p refs

(Contract NAS3-13477)

(NASA-CR-72847; ADL-71965) Avail: NTIS CSCL 11C

An attempt was made to form a dense, adherent yttrium oxide-chromium oxide coating on a high strength chromium alloy (Cr-7Mo-2Ta-0.093-0.1(Y + La)), in order to protect the alloy from nitrogen embrittlement due to air exposure. Yttrium was deposited on the alloy surface electrolytically from a molten fluoride bath. Excess salt was removed by vacuum evaporation, and the mixed Y_2O_3-Cr_2O_3 was formed by preoxidation at 1500 F (1089 K) in H_2/H_2O gas mixtures. The coating failed to provide the necessary oxidation/nitridation resistance at 2100 F (1422 K), probably because of non-uniform coverage and lack of coherency. Author

N71-23137# Mound Lab., Miamisburg, Ohio.

SOLUBILITY OF TRITIUM IN ANNEALED AND COLD WORKED COPPER

J. D. Braun, K. F. Chaney, G. L. Downs, and G. W. Powell 8 Jan. 1971 6 p refs

(Contract AT(33-1)-GEN-53)

(MLM-1734) Avail: NTIS

The solubility and diffusivity of tritium in both cold-worked and annealed copper is being investigated as a continuation of work on metals with face centered cubic structures. Samples were exposed to a tritiated gas mixture over a range of 100 to 300 C. Preliminary results indicated the tritium solubility at 300 C is much greater than that reported in the previous literature. Possible errors in experimental techniques which might explain the results obtained are being investigated. Author (NSA)

N71-23148# Joint Publications Research Service, Washington, D.C.

HIGH STRENGTH AUSTENITIC STEELS

M. V. Pridantsev et al 14 Apr. 1971 108 p refs Transl. into ENGLISH from the book 'Vysokoprochnyye Austenitnyye Stali' Moscow, Metallurgiya Publishing House, 1969 p 82–125, 165–195, and 214–241

(JPRS-52877) Avail: NTIS

The results of a study of the effect of alloying, hot working, heat treatment conditions, and the degree of cold plastic flow on structural transformations and mechanical properties of Cr-Mn-Ni stells are reported. Corrosion resistance and chemical composition of the steels are included. Author

N71-23165# Oak Ridge National Lab., Tenn.

FABRICATION PROCEDURES AND ACCEPTANCE DATA FOR ASTM A-533 WELDS AND A 10-IN THICK ASTM A-543 PLATE OF THE HEAVY SECTION STEEL TECHNOLOGY PROGRAM Documentary Report

C. E. Childress Jan. 1971 86 p refs

(Contract W-7405-eng-26)

(ORNL-4313-3; Rept-3) Avail: NTIS

Welding parameters for ASTM A-533 grade B steel weldaments are outlined. Data relative to an electroslag weldament are presented in addition to the data for submerged-arc and shielded-metal-arc weldaments. A 10 in. thick ASTM A-543 steel plate was tested to provide additional base material for investigation. The fabrication and processing history of the A-543 plate is provided. Author (NSA)

N71-23184*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

METAL STRUCTURES WITH PARALLEL PORES OF UNIFORM SIZE

J. Sherfy Washington Apr. 1971 15 p refs

(NASA-TN-D-6259; G-1015) Avail: NTIS CSCL 11F

A wide variety of techniques for the preparation of metallic structures with parallel, uniformly sized pores is described critically. One of these techniques is already employed commercially, but others may be totally impractical. The method chosen will depend on the characteristics of the structure to be fabricated. Some of the processes described are applicable to materials other than metals. Author

N71-23248* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

HIGH TEMPERATURE FERROMAGNETIC COBALT-BASE ALLOY Patent

John C. Freche, Richard L. Ashbrook, Gary D. Sandrock, and Robert Lewis, inventors (to NASA) Issued 10 Dec. 1968 (Filed 31 May 1966) 6 p Cl. 75-170

(NASA-Case-XLE-03629; US-Patent-3,415,643; US-Patent-Appl-SN-554950) Avail: US Patent Office CSCL 11F

The properties and composition of ferromagnetic cobalt-base alloy are described, including high strength at 1500 F while exhibiting high magnetic induction at low applied fields. This cobalt alloy is suggested for use in electrical power generating equipment in aerospace vehicles. J.A.M.

N71-23280# Army Materials and Mechanics Research Center, Watertown, Mass.

THE MECHANICAL PROPERTIES OF THREE TITANIUM ALLOYS

Perry R. Smoot and James D. Colgate Sep. 1970 16 p

(AD-718040; AMMRC-TR-10-26) Avail: NTIS CSCL 11/6

The mechanical properties of three titanium-base alloys were investigated, and based on the properties obtained, these alloys should be considered for use in applications requiring tough, high strength, lightweight materials. The effect of heat treatment variables on the mechanical properties of all three alloys, and the effect of additions of O, C, N, and B on the properties of alloy C were determined. Variations in heat treatment resulted in a wide range of strength and toughness. Additions of O, C, N, and B to alloy C reduced toughness at low strength levels and, with the exception of boron, increased the maximum strength attained. Author (GRA)

N71-23284# Brown Univ., Providence, R.I. Div. of Engineering.

INELASTIC CONSTITUTIVE RELATIONS FOR SOLIDS: AN INTERNAL VARIABLE THEORY AND ITS APPLICATION TO METAL PLASTICITY

James R. Rice Jan. 1970 46 p refs

(Contract N00014-67-A-0191-0003)

(AD-718400; TR-12) Avail: NTIS CSCL 20/12

Constitutive laws at finite strain are studied for a class of inelastic solids. These exhibit inelasticity as a consequence of specific structural rearrangements, on the microscale, of constituent elements of materiel (a case being metal plasticity as a consequence of dislocation motion). The theory of such materials is developed in general terms, with internal variables representing the structural rearrangements. The greatest emphasis is placed on the normality structure which emerges in constitutive laws when the rate of each structural rearrangement is governed by its associated thermodynamic force. A scalar potential function of stress is then shown to exist at each instant during the deformation so that its derivatives are the components of the inelastic portion of the strain rate. The limiting case of a time-independent material and yield surface normality is discussed as well, as are some thermodynamic features of the internal variable model. Constitutive laws for metal plasticity are studied from this viewpoint: Crystalline slip is the presumed mechanism of structural rearrangement, and this characterized through both a continuum and a discrete dislocation slip model. The assumption that associated thermodynamic forces govern rates, which leads to the macroscopic normality structure, is shown to reduce in cases of small elastic distortions to the commonly assumed stress dependence of metallic slip in terms of resolved shear stresses on slip systems or of glide forces per unit length of dislocation line. Author (GRA)

N71-23368* North American Aviation, Inc., Downey, Calif.

BRAZING ALLOY Patent

Donald Smith, inventor (to NASA) Issued 26 Nov. 1968 (Filed 20 Jan. 1966) 3 p Cl. 75-172 Sponsored by NASA

(NASA-Case-XNP-03063; US-Patent-3,413,115; US-Patent-Appl-SN-521994) Avail: US Patent Office CSCL 11F

A brazing alloy is investigated which is adapted to brazing corrosion resistant steel to refractory metals, as well as for brazing refractory metals to other refractory metals. It consists of palladium, silver, and silicon with impurities held to relatively minute quantities. With discrete adjustment of component quantities, brazing with this alloy may occur at low temperatures in a short period of time. When this alloy is used for bonded pipes it meets the following requirements: the brazed region is ductile to resist vibrations, leakage is minimal or a prescribed quantity, and the brazed region is inert to the fluid carried in the pipes. It was determined that although brazing occurs at 1450 F, the brazing temperature has little effect on the properties of the brazed joint so long as the temperature is above that at which the brazing alloy flow commences. E.M.C.

N71-23389# Massachusetts Inst. of Tech., Cambridge.

STRUCTURE AND PROPERTY CONTROL THROUGH RAPID QUENCHING OF LIQUID METALS Semiannual Technical Report, 1 Jul. – 31 Dec. 1970

Nicholas J. Grant, Regis M. N. Pelloux, Merton C. Flemings, and Ali S. Argon 1 Jan. 1971 81 p refs

(Contract DAHC15-70-C-0283; ARPA Order-1608)

(AD-718902) Avail: NTIS CSCL 11/6

The first results of the processing of coarse metal powders of maraging 300 and IN 100 are reported. The effect of cooling rates on the dendrite structure of maraging 300 alloy has been investigated in a wide range of cooling rates. The structure of atomized particles are presented and their cooling rates are derived from the dendrite arm spacings. The size and distribution of inclusions in a commercial 300 grade maraging has been determined and related to the mechanical properties (tensile and fatigue). The analysis of the stress and strain conditions around an inclusion as a function of the overall state of stress is being investigated in order to determine the crack initiation criteria. Author (GRA)

N71-23403*# Techtran Corp., Glen Burnie, Md.

HIGH TEMPERATURE PLASTICITY FAILURE OF TITANIUM [O VYSOKOTEMPERATURNOM PROVALE PLASTICHNOSTI TITANA]

B. A. Kolachev et al Washington NASA Mar. 1971 9 p refs Transl. into ENGLISH from Tr. Mosk. Aviats. Tekhnol. Inst. (Moscow), no. 66, 1966 p 96 – 102

(Contract NASw-2037)

(NASA-TT-F-13563) Avail: NTIS CSCL 11F

Investigations were performed to demonstrate that plasticity failure occurs in vacuum-treated titanium in the 300-550 C temperature interval. In hydrogen-saturated titanium, this failure is added at low extension rates to hydrogen brittleness, resulting from directed diffusion of hydrogen toward imperfections in the crystalline structure and grain boundaries. The influence of hydrogen on the properties of titanium in this temperature interval is similar to deformation aging. Author

N71-23486# Sandvikens Jernwerks, A. B. (Sweden) Staalforskningen.

TEXTURE AND ANISOTROPY IN ZIRCONIUM IN RELATION TO PLASTIC DEFORMATION [TEXTUR OCH ANISOTROPI HOS ZIRKONIUM I RELATION TILL PLASTISK DEFORMATION]

Krister Kaellstroem (Ph.D. Thesis – Roy. Inst. of Technol., Stockholm) 1970 40 p refs In SWEDISH

Avail: NTIS

The crystal structure has a polyvalent rotational symmetry around this axis. The connection between the production of polycrystalic metal and possible isotropic properties of the finished material is investigated. The anisotropy in hexagonal, closed packed metal zirconium is due to the presence of a unique orientation. ESRO

N71-23624# Air Force Systems Command, Wright-Patterson AFB, Ohio. Air Force Materials Lab.
HYPERVELOCITY IMPACT: MATERIAL STRENGTH EFFECTS ON CRATER FORMATION AND SHOCK PROPAGATION IN THREE ALUMINUM ALLOYS
Ronald F. Prater Dec. 1970 247 p refs
(AD-718461; AFML-TR-70-295; DS/MC/67-2) Avail: NTIS CSCL 11/6

The effects of material strength upon the transient response of thick aluminum targets to hypervelocity impact has been studied experimentally. Most experiments involved the normal impact of 2017 aluminum spheres at a velocity of about 7 km/sec. Material strength was varied by employing targets of 1100, 6061, and 7075 aluminum alloys. Flash x-ray techniques were used to measure accurately the rate at which the crater grew during the impact process. Crater growth rates were also measured for 1100 aluminum in four separate ranges of projectile velocity from 2.3 km/sec to 7.0 km/sec. Free surface velocity and Hopkinson fly-off disk techniques were used to measure values of the peak normal stress at various distances from the impact point (between 1 cm and 10 cm) at several related angles away from the projectile trajectory. The measurements of the variation of stress amplitude with distance into the target demonstrated significant non-hydrodynamic stress attenuation believed to be associated with propagation of an elastic relief wave from the rear of the impacting projectile. Numerical calculations yield reasonable agreement with experimental results, but many of the details are in question. Measurement of shock arrival time with quartz disk sensors confirmed the elastic-plastic behavior of the target material. Author (GRA)

N71-23674# Army Weapons Command, Rock Island, Ill. Research and Engineering Directorate.
APPLICATION OF ELECTROCHEMICAL TECHNIQUES: CORROSION INHIBITORS ON STEEL
Peter Martin, Jr. Sep. 1970 33 p refs
(AD-718063; AMSWE-RE-70-135) Avail: NTIS CSCL 11/6

Electromechanical techniques were used to study the corrosion of metals in aqueous environments to determine whether the anodic or cathodic process, or both, controls corrosion and the mechanism of film-formation or dissolution. Potentiostatic and potentiodynamic polarizations were conducted on mild steel in neutral and salt solutions, and on mild steel coated with various sulfonate inhibitors in salt solutions. Corrosion rates of mild steel and of mild steel coated with sulfonate inhibitor were determined by use of the Tafel extrapolation and the linear polarization methods. Salt solutions caused a reduction in the span of the passive range and caused dissolution of the mild steel at a lower potential when compared with mild steel in neutral solutions. The adsorption of sulfonate inhibitors on mild steel caused a lower initial rest potential and a lower current density. The Tafel extrapolation and the linear polarization methods gave reproducible corrosion rates for mild steel alone. However, only the latter method could be used to determine the corrosion rates of mild steel coated with an inhibitor. Author (GRA)

N71-23675# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
WEAR OF METAL BY A HYDROABRASIVE FLOW
S. P. Kozyrev 24 Nov. 1970 16 p refs Transl. into ENGLISH from Mashinovedenie (USSR), no. 6, 1969 p 106-112
(AD-718478; FTD-HT-23-732-70) Avail: NTIS CSCL 11/6

The article deals with the wear of metals by a hydroabrasive stream at small angles of action of the abrasive particles. The mechanism of abrasive wear is defined and the equation of wear is derived. Author (GRA)

N71-23718# Technische Hogeschool, Delft (Netherlands). Afdeling der Technische Natuurkunde.
INFLUENCE OF SOME TRACE ELEMENTS ON THE QUENCHING STRUCTURE AND PRECIPITATION BEHAVIOR OF AN Al-4 WEIGHT PERCENT COPPER ALLOY [INVLOED VAN ENIGE SPORENELEMENTEN OP AFSCHRIKSTRUCTUUR EN PRECIPITATIEGEDRAG VAN EEN AL-4 GEW PERCENT CU-LEGERING]
Johannes Baptist Maria Nuyten (Ph.D. Thesis) Jan. 1970 105 p refs In DUTCH; ENGLISH summary
Avail: NTIS

The influence of small additions (0.02 weight percent) of cadmium, indium, and tin on the precipitation behavior of aluminum-1.7 weight percent copper alloys is discussed. The experimental techniques used are transmission electron microscopy, dilatometer, resistivity, and internal friction measurements. ESRO

N71-23770# Oak Ridge National Lab., Tenn.
HEAVY SECTION STEEL TECHNOLOGY PROGRAM Semiannual Progress Report, Period Ending 28 Feb. 1970
Oct. 1970 256 p refs
(Contract W-7405-eng-26)
(ORNL-4590) Avail: NTIS

The results of research and development are summarized. Included are reports on the structural behavior of thick-section plates, investigation of irradiated and unirradiated materials, pressure vessel investigation, transition temperature, and fracture mechanics. F.O.S.

N71-23777# TRW, Inc., Cleveland, Ohio. Materials Technology Lab.
EFFECT OF ALLOYING ELEMENTS ON TEMPERED MARTENSITE EMBRITTLEMENT AND FRACTURE TOUGHNESS OF LOW ALLOY HIGH STRENGTH STEELS Final Report, 13 Mar. 1969 - 13 Aug. 1970
C. Vishnevsky Jan. 1971 88 p refs
(Contract DAAG46-69-C-0060)
(AD-718041; ER-7384-1; AMMRC-CR-69-18/F) Avail: NTIS CSCL 11/6

A study was performed on the influence of various elements on the notch bend fracture toughness at 75F and -100F of .35%C, 3Ni-Cr-Mo-V martensitic steels tempered between 400 and 800F. The elements examined included C, Mn, Si, Cr, Ni, Mo, Co, V and Al. The overall variation in room temperature yield and tensile strengths for twenty-four steels was 155-230 ksi yield strength and 188-288 ksi tensile strength. Author (GRA)

N71-23793# Naval Research Lab., Washington, D.C. Physical Metallurgy Branch.
MARINE CORROSION STUDIES: THE CORROSION CHARACTERISTICS AND RESPONSE TO CATHODIC PROTECTION OF COPPER ALLOYS IN QUIESCENT SEAWATER Interim Progress Report
R. E. Groover, T. J. Lennox, Jr., and M. H. Peterson Oct. 1970 53 p refs
(AD-718310; NRL-MR-2183) Avail: NTIS CSCL 11/6

The corrosion characteristics, dealloying susceptibility, marine fouling characteristics, and the response to cathodic protection of seventeen copper alloys and unalloyed copper, which served as a control, were studied in quiescent seawater. Detailed examination after 735 days showed that several alloys in the unprotected condition had severely corroded either by deep localized attack or by dealloying. The corrosion rates were determined; on the unprotected specimens a maximum rate of 0.74 mils per year was observed. Cathodic protection from zinc anodes reduced the corrosion rate to essentially zero and prevented localized corrosion except in Naval brass and Muntz metal where metallurgical studies indicated that dealloying was not completely prevented. Histograms have been presented for the electrochemical potentials of each specimen, and a galvanic series for the copper alloys has been included. There was no correlation between the electrochemical

potentials and the type or severity of corrosion. The resistance of the copper alloys to marine fouling varied widely. All unprotected specimens fouled to some extent, whereas the cathodically protected specimens were heavily fouled. Author (GRA)

N71-23795*# National Aeronautics and Space Administration. Washington, D.C.
LOW TEMPERATURE MECHANICAL PROPERTIES OF VARIOUS ALLOYS: COMPILATION
1970 24 p
(NASA-SP-5921(01)) Avail: NTIS CSCL 11F

Low-temperature mechanical properties of some 20 alloys are reported, most of them are high in strength and resist corrosion. The usual range of temperatures is from 70 to −423F. Apart from their interest ot metallurgists these data bear on the suitability of these alloys for storage vessels, pumps, and other handling equipment for corrosive or noncorrosive liquids or gases at normal and cryogenic temperatures. Author

N71-23828* North American Aviation, Inc., El Segundo, Calif.
ETCHING OF ALUMINUM FOR BONDING Patent
Isidore Pollack and Wendall D. Emde, inventors, (to NASA) Issued 17 Dec. 1968 (Filed 4 May 1965) 3 p Cl. 148-6.20 Sponsored by NASA
(NASA-Case-XMF-02303; US-Patent-3,416,975; US-Patent-Appl-SN-453229) Avail: US Patent Office CSCL 11F

Aluminum and aluminum-base alloys are treated by etching with an aqueous solution containing sulfuric acid, hydrofluoric acid and an alkali metal dichromate. This treatment prepares the surface of the metal for adhesive bonding.
Official Gazette of U.S. Patent Office

N71-23982*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MECHANICAL PROPERTIES OF A TUNGSTEN 23.4-PERCENT-RHENIUM 0.27-PERCENT-HAFNIUM CARBON ALLOY
William D. Klopp and Walter R. Witzke Washington Apr. 1971 23 p refs
(NASA-TN-D-6308; E-6090) Avail: NTIS CSCL 11F

The alloy was arc-melted, fabricated, and evaluated to determine if particle strengthening by hafnium carbide could be achieved in a ductile, tungsten - high-rhenium matrix. The alloy was found to exhibit a good combination of tensile and creep strength to 3000 F with a ductile-brittle transition temperature near room temperature. Author

N71-24012# Gulf Radiation Technology, San Diego, Calif.
MEASUREMENT OF SURFACE WAVES PRODUCED BY SMALL EXPLOSIONS IN ALUMINUM Final Report, Aug. 1967–Jul. 1969
H. R. Kratz and B. Hartenbaum Aug. 1970 56 p
(Contract DAS01-67-C-0095)
(AD-717985; GA-10291; DASA-2594) Avail: NTIS CSCL 19/4

Measurements were made o the surface motion produced by the detonation of a small high explosive charge just beneath the surface of an aluminum block. The vertical displacement of the surface as a function of time was measured with capacitor type displacement gauges. Measurements were made at several distances from the charge and the aluminum block was large enough that reflection from the bottom or sides did not interfere with surface displacements during the period of measurement. The experiments showed the existence of three distinct surface waves. The velocity of the first wave was that of a dilatational wave in aluminum and the second wave that of a shear wave. The velocity of the third wave was nearly the same as that of the second wave, but its arrival was delayed beyond that of the second wave. The amplitude of the third wave was somewhat larger than that of either of the first two waves. Calculations which were performed at Shock Hydrodynamics, Inc., showed the same three waves that were 1observed in the experiments. The calculated wave amplitudes were greater than those measured; the differences may have resulted from using too great an explosive energy release in the calculations. The third wave was interpreted from the calculations as one which was generated by the elastic rebound of the crater. GRA

N71-24077# Technische Hogeschool, Delft (Netherlands). Afdeling der Technische Natuurkunde.
SURFACE MARTENSITE AND ANGULAR PROFILE MARTENSITE IN IRON-NICKEL [OPPERVLAKTE MARTENSIET EN HOEKPROFIEL MARTENSIET IN IJZER-NIKKEL]
Joseph Anton Klostermann (Ph.D. Thesis) 1970 114 p refs In DUTCH; ENGLISH summary Sponsored by Ned. Organisatie voor Zuiver-Wetenschap. Onderzoek
Avail: NTIS

An investigation of martensitic transformation by plastic deformation of iron-nickel single crystals, yielded two special forms of martensite. Firstly surface formations were observed in a thin layer, and secondly needle-shaped formation. These observations are studied and explained. ESRO

N71-24088*# AiResearch Mfg. Co., Phoenix, Ariz.
DEVELOPMENT AND TESTING OF LIQUID METAL FILM THICKNESS INSTRUMENTATION Final Report
Feb. 1971 121 p
(Contract NAS3-10611)
(NASA-CR-72821; APS-5357-R) Avail: NTIS CSCL 11F

An existing transducer for measuring relative shaft motions, within a 600 F alkali-metal environment, was upgraded to measure potassium films at temperatures from 600 to 1000 F. Various combinations of transducer and journal materials, effects of coil and wire diameters, temperature, frequency, and holder material were investigated to pinpoint key parameters affecting probe sensitivity. Based on the studies, probes were fabricated, tested to 800 F, 14,000 rpm, and found to have sensitivities from 0.040 to 0.099 V/mil, using a secondary to primary coil-turns ratio of 1.5:1. Al2O3 coil cores of 0.46 in. dia were wound with No. 36 Ni-clad silver wire coated with ceramicite insulation. This combination of materials provides stable resistivity with time at high temperatures. Author

N71-24090 National Lending Library for Science and Technology, Boston Spa (England).
STRUCTURE AND COERCIVE FORCE OF A Co/Al ALLOY
A. A. Pavlyukov et al 7 Jan. 1971 7 p refs Transl. into ENGLISH from Fiz. Metal. i. Metalloved. (USSR), v. 29, no. 4, 1970 p 888–890
NLL-CE-Trans-5523-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The values of the coercive force of the Co/Al alloy investigated are determined by the condition and quantity of the two phases; the matrix and the phase of precipitations with fcc lattice. With a small quantity of the alpha prime phase in the alloy (chilled state) the coercive force of the alloy is low. With increase in the quantity of this phase during aging there is also an increase in H sub c. A reduction in the coercive force after aging at temperatures above 600 C is apparently due either to an increase in size of the particles of the alpha prime phase or to a reduction in the microdistortions in the alloy. Author

N71-24093# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A NEW REFRACTORY ECONOMICAL COMPOSITION

ALLOY FOR PROLONGED SERVICE AT HIGH TEMPERATURES

A. R. Krylov et al 19 Nov. 1970 11 p Transl. into ENGLISH from Sb. Tr. Tsentr. Nauchn. Issled. Inst. Chernoi Met. (Moscow), no. 65, 1968 p 19–23

(AD-718473; FTD-HT-23-569-70) Avail: NTIS CSCL 11/6

The work deals with the properties of the cast Kh25N25G6V5MBAR high-temperature alloy which was specially developed for prolonged service (up to 10,000 hr) at 900 degrees centigrade in atmospheres with a high content of hydrogen. In the cast state this alloy has an austenitic structure with a large number of carbides. Reheating at 900-1100 degrees centigrade for 1 hr with subsequent quenching resulted in the coagulation and partial dissolution of the carbides. The mechanical properties of specimens of melts containing 0.12 and 0.4 percent C were determined with the aid of short-term tensile tests and it was found that at room temperature the specimens with the higher C content displayed a markedly higher ultimate strength. At operating temperatures increasing the C content to 0.4 percent did not affect short-term strength but it significantly increased plasticity. In long-time (stress-rupture) strength tests increasing the C content produced no effect. The limits of the stress-rupture strength of this new alloy, which contains approximately 36 percent Fe, after 100, 1000 and 10,000 hr of exposure to 900 degrees C are 7.5-9.0, 5.0-6.0 and 3.3-4.0 kg/mm(superscript 2), respectively, i.e. they are nearly as high as in complex Cr-Ni alloys. Its impact strength in cast state is given. GRA

N71-24099# Aeronautical Research Labs., Melbourne (Australia).

THE COMPARATIVE RESISTANCE OF CHROMIUM AND NICKEL BASED ALLOYS TO CORROSIVE ATTACK BY VANADIUM UNDER SIMULATED GAS TURBINE CONDITIONS

O. Wilson Aug. 1970 21 p refs

(ARL/ME-319) Avail: NTIS

Turbine stator blades manufactured from alloys based on nickel or on chromium have been exposed for periods up to 100 hours to the corrosive products of combustion of a typical residual fuel oil, under conditions simulating operation in a gas turbine. Results with Nimonic 80A blades give corrosion rates similar to those predicted by other workers and hence confirm the suitability of the test rig for comparative testing of alloys. Despite the unsuitability of the method of stripping of scale deposits first used for chromium alloy E, it has been shown that this alloy possesses superior resistance to corrosion and warrants further testing using improved experimental techniques. Author

N71-24121 National Lending Library for Science and Technology, Boston Spa (England).

SOLUBILITY OF OXYGEN IN NIOBIUM-ZIRCONIUM ALLOYS

A. K. Shurin et al 7 Jan. 1971 7 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Metally (Moscow), v. 1, 1970 p 231–233

(NLL-CE-Trans-5504-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The phase composition of Nb-Zr-O alloys has not been investigated. It is merely shown that phases of ZrO2, NbO and an alpha-Zr-base solid solution form in these alloys at 1,000 C. The positions of the boundaries of the phase zones have not been determined. The alloys were prepared from very pure components - niobium from electron beam smelts and zirconium from zirconium iodide. Oxygen was introduced into the alloys by adding to the charge niobium pentoxide prepared by oxidation of a chip of niobium. To obtain alloys with low oxygen contents, a master alloy was used which was an alloy of niobium with 3% atmospheric O. Author

N71-24122 National Lending Library for Science and Technology, Boston Spa (England).

NONDESTRUCTIVE TESTING METHODS FOR ZIRCALOY CLADDING TUBES [ZERSTOERUNGSFREIE PRUEFVERFAHREN FUER ZIRCALOY-HUELLROHRE]

G. Krohm 13 Jan. 1971 8 p Transl. into ENGLISH from Atomwirtschaft (Duesseldorf), v. 15, no. 8, Aug. 1970 p 392–393 In ENGLISH and GERMAN

(NLL-Windscale-446-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Continuous testing for defects, investigating and recording cladding geometry constitute non-destructive testing of zircaloy fuel element cans. Defects in the material can be located and the wall thickness measured by ultrasonic techniques. An induction measuring technique is used for checking outer diameters. Eccentricity, ovality and inner diameter are checked using a combined ultrasonic/induction method which offers many possible variations. Author

N71-24142* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

PROCESS FOR PRODUCING DISPERSION STRENGTHENED NICKEL WITH ALUMINUM Patent

John W. Weeton, Max Quatinetz, and Norman W. Orth, inventors (to NASA) Issued 26 Aug. 1969 (Filed 24 Jul. 1967) 4 p Cl. 148-126; Int. Cl. C21d1/00, 1/26, 9/00

(NASA-Case-XLE-06969; US-Patent-3,463,679; US-Patent-Appl-SN-655675) Avail: US Patent Office CSCL 11F

Dispersion strengthened nickel containing ultrafine dispersoids from mechanically produced blends of matrix and dispersoid aluminum powders is described. Microstructural stability is achieved by carefully controlling the cleaning and densification of partially consolidated thin shapes.

Official Gazette of the U.S. Patent Office

N71-24191 National Lending Library for Science and Technology, Boston Spa (England).

TECHNIQUE FOR CONTROLLED ROLLING OF ALLOY STEELS FOR THE PRODUCTION OF MEDIUM THICK FLAT LAMINATES, WITH A HIGH DEGREE OF STRENGTH AND STIFFNESS

R. Civallero and C. Parrini 19 Jan. 1971 18 p refs Transl. into ENGLISH from Proceedings of the Intern. Congr. of the Sci. and Technol. of Iron and Steel (Tokyo), 7–13 Sep. 1970

(NLL-M-20179-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The technique of controlled rolling, during the process of rolling flat bloom into sheet is discussed. A routine practice for the production of 5 - 35 mm gauge sheet, in low-carbon steel, killed and semi-killed, both with and without the addition of small quantities of niobium, using 30 ton slabs is described. Niobium steel is particularly sensitive to the austenitation temperature as well as to the rolling technique. By using the parameters appropriately it is possible to produce 'as rolled' sheet up to a yield-point of 50 kg/sq.mm and a breaking-point of 62 kg/sq.mm. Author

N71-24209# North Carolina Univ., Chapel Hill.

IMPURITY DIFFUSION IN ALUMINUM AND ITS DILUTE ALLOYS

W. B. Alexander and L. M. Slifkin [1970] 7 p refs Presented at Intern. Conf. on Atomic Transport in Solids and Liquids, Marstrand, Sweden, Jun. 1970

(Contract AT(40-1)-2036)

(ORO-2036-21; CONF-700639-1) Avail: NTIS

Recent data on the diffusion of impurity tracers in aluminum indicate that group B solutes generally have activation energies and pre-exponential factors which are rather close to those for aluminum

self diffusion; the anomalies reported by others appear to have been due to the effects of surface oxide. In aluminum, ion core effects seem to be as important as simple electrostatic considerations in describing vacancy-impurity interactions. The long range effects of the oscillating screening potential can be seen in the increase of tracer diffusion coefficients upon doping with small amounts of mono- and di-valent solutes. The diffusion of transition metal tracers proceeds with extremely large activation energies and pre-exponential factors. Author

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N71-23107# California Univ., Berkeley. Lawrence Radiation Lab. Inorganic Research Materials Div.

DEFECTS AND PHASE TRANSFORMATIONS IN COBALT FERRITES

Lutgard C. De Jonghe (Ph.D. Thesis) Nov. 1970 138 p refs
(Contract W-7405-eng-48)
(UCRL-20369) Avail: NTIS

Defects and phase transformations in ferrimagnetic cobalt ferrites, with a Co/Fe ratio between 0.54 and 0.76, have been studied by means of high voltage transmission electron microscopy. The origin and characterization of ion radiation damage, ferrimagnetic domains, dislocations, and phase transformations in air and in the electron microscope are discussed. Ferrimagnetic domains have been observed in single phase specimens, when the foils were symmetrically oriented with respect to the field of the objective lens. The domain wall images have been found to be in agreement with the contrast that is expected from 90 deg Bloch walls. The configuration and motion of these 90 deg walls is shown to depend on the foil geometry, and on the presence of mechanical stresses. Phase transformations in the reducing atmosphere of the microscope have been examined in detail. Author (NSA)

N71-23108*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

CRYSTALLITE ORIENTATION IN MOLDED GRAPHITES

David R. Schryer Washington Apr. 1971 29 p refs
(NASA-TN-D-6200; L-7519) Avail: NTIS CSCL 11D

An extensive investigation of the orientation of crystallites in molded artificial graphite has shown that the crystallites in such graphites are usually, but not always distributed symmetrically about a single axis. The symmetry axis has been found to differ frequently from the forming axis, contrary to what has generally been assumed. Furthermore, the direction of the symmetry axis and the degree of orientation have been found to vary within a given graphite block. A two-parameter equation has been found to be suitable for describing the distribution of crystallites about the symmetry axis. Specification of the direction of the symmetry axis involves two additional parameters. A technique for evaluating these parameters from experimental data is presented. Author

N71-23232# Boeing Co., Renton, Wash.

FLAMMABILITY AND DESIGN CONSIDERATIONS FOR COMMERCIAL AIRPLANE INTERIOR MATERIALS

W. S. Perkowski and R. G. Cheatham [1971] 16 p refs
Avail: NTIS

Plastic materials and textiles used for the interiors of commercial aircraft are discussed from the standpoint of flammability, cost, and weight. Design considerations which are used in the choice of materials are: (1) the materials must meet the FAA certification requirements, (2) the materials must provide a maximum of weight for functional use, (3) the materials must provide the lowest and most realistic cost, and (4) the materials must provide a pleasing and acceptable decor. Author

N71-23236# Royal Aircraft Establishment, Farnborough (England).

THE INFLUENCE OF MORPHOLOGY AND SUBSTRUCTURE OF FIBRES ON THE MECHANICAL PROPERTIES AND THE BEHAVIOUR ON DEGRADATION, PARTS 1 AND 2 [DER EINFLUSS VON MORPHOLOGIE UND FEINSTRUKTUR VON FASERN AUF DIE MECHANISCHEN EIGENSCHAFTEN UND DAS VERHALTEN BEIM ABBAU 1 UND 2]

H. Kraessig et al Jul. 1970 40 p refs Transl. into ENGLISH from Chemiefaser (West Germany), v. 9, no. 7 and 8, 1969 p 540–547 and 612–616
(RAE-Lib-Trans-1467) Avail: NTIS

Existing information on the morphology and structure of natural and synthetic fibers is discussed. It is concluded that the strength and ductility of the fibers are determined by the number of intramicellar intact molecular bridges and also by the degree of lateral order. Degradation by radiation was used to obtain information on the bonding that exists between the crystallites in a fiber. It is shown that bonding between crystallites or lamellae by individual macromolecules is more probable than bonding by molecular bundles. Author

N71-23261# Pennsylvania Univ., Philadelphia. Lab. for Research on the Structure of Matter.

LABORATORY FOR RESEARCH ON THE STRUCTURE OF MATTER Annual Technical Report, 1 Jul. 1969–30 Jun. 1970

Eugene R. Nixon 30 Jun. 1970 287 p refs
(Contract ARPA SD-69)
(AD-714864; ATR-10) Avail: NTIS CSCL 11/7

Research summaries are given which pertain to the following topics: Basic chemistry and synthesis; Reaction kinetics and mechanisms; Structure of materials; Thermodynamics and transport properties; Mechanical properties; Phase transformations and defects; Surfaces and thin films; Interfaces and electrodes; Electronic and magnetic properties; Optical and acoustic properties; and Quantum mechanics and statistics. GRA

N71-23279# Norton Research Corp., Cambridge, Mass.

DEVELOPMENT OF LAMINATE METAL MATRIX COMPOSITES Final Report, 3 Nov. 1969–31 Oct. 1970

M. J. Hordon Nov. 1970 51 p refs
(Contract N00019-70-C-0233)
(AD-717968; Rept-5120-1-00233) Avail: NTIS CSCL 11/4

Laminar composites were fabricated by diffusion bonding boron carbide coated titanium foil sheets with individual layer thicknesses varying in the range 2-25 um. The mechanical properties varied with boron carbide content. At 42 pct. BC reinforcement, the biaxial, planar tensile strength and elastic modulus was 105 ksi, and 35.1 x 10 to the 6th psi, respectively. For laminates bonded above 850C, a brittle reaction phase zone was formed. Fracture crack patterns were observed to extend along the reaction phase boundary. Interlaminar shear strength values of 4000-5800 psi can be attributed to brittle phase formation. Author (GRA)

N71-23282# Ceramic Finishing Co., State College, Pa.

CHEMICAL STRENGTHENING OF CERAMIC MATERIALS Summary Report, 7 Jan.–6 Dec. 1970

Henry P. Kirchner, W. R. Beaussem, Robert M. Gruver, Dennis R. Platts, and Ralph E. Walker 6 Dec. 1970 169 p refs
(Contract N00019-70-C-0418)
(AD-717983) Avail: NTIS CSCL 11/2

In polycrystalline ceramics subjected to external forces fracture originates at surface flaws. Compressive surface layers prevent surface flaws from acting to cause failure. Therefore, compressive surface layers can be used to obtain improved strengths. In the investigation, treatments were applied to alumina, zirconium diboride, silicon carbide and zircon porcelain bodies. The methods used included quenching, glazing and quenching, formation of low expansion surface layers by reaction with powders at high temperatures, and chemical vapor deposition of low expansion surface layers. Glazing and quenching improved the strength of 96% alumina body. Preliminary evidence of strengthening by chemical vapor deposition of surface layers was obtained. Other properties of the treated materials that were determined included the elevated temperature flexural strength and the impact resistance. Fractographic techniques were used to investigate the fracture mechanisms and the fracture origins. Residual stress profiles were calculated and were used to calculate the outer fiber stress and the stress at the volume flaws. Author (GRA)

N71-23327# Avco Corp., Lowell, Mass. Systems Div.
TRANSPORT PROCESSES IN CERAMIC OXIDES Semiannual Technical Report, 16 Jun. – 15 Dec. 1970
Thomas Vasilos, Philip E. Gruber, Bernhardt J. Wuensch, and William H. Rhodes 15 Dec. 1970 37 p refs
(Contract DAHC15-68-C-0296; ARPA Order 1130)
(AD-718886; AVSD-0092-71-CR) Avail: NTIS CSCL 11/2

Progress is described in a program intended to clarify the nature of mass transport in MgO through (1) growth of crystals of improved perfection and purity, (2) measurement of cation self-diffusion rates over a wide range of temperatures, and (3) extension of diffusion measurements as close as possible to the melting point of the material. Crystals of MgO2 cm in diameter and 2 mm in thickness are routinely and reproducibly grown epitaxially on MgO substrates by means of chemical vapor transport with HCl at 1000 C. Measurements of Ni(2+) diffusion in MgO have been extended to 2460C (0.88 T(M)) in an attempt to reveal intrinsic transport. The measurements extend by 70% the temperature range over which transport data for MgO are now available, but fail to reveal a change in transport mechanism. Mg26 self-diffusion in MgO in the temperature range 1600-2250C was studied. The results are interpreted as extrinsic diffusion and are not in accord with limited data in the literature for diffusion of the radioisotope Mg28. Neither of the present diffusion studies has revealed a significant difference between transport in moderate purity crystals and crystals of the best quality which are commercially available. Author (GRA)

N71-23329# Naval Ordnance Lab., White Oak, Md.
A COMPARISON OF FIVE SILOXANYLCARBORANE POLYMERS
J. M. Augl 7 Dec. 1970 19 p
(AD-718329; NOLTR-70-240) Avail: NTIS CSCL 11/10

Thermal properties of five structurally different siloxanylcarborane polymers are compared. Two polymers contain B10-carborane groups, two B5 groups, and one a B8-carborane group. Their polymer decomposition temperatures (ranging from 440 to 550 C) depend on their chemical structure. Polymers containing the B10-carborane moiety are thermally the most stable. They also show a longer retention of flexibility upon exposure to 250C. These polymers show potential for high temperature rubbers. Author (GRA)

N71-23379# Vermont Univ., Burlington.
THE FRACTURE ENERGY OF COMPOSITE MATERIALS Final Report, 1 Sep. 1969 – 31 Aug. 1970
John O. Outwater and Michael C. Murphy 1 Feb. 1971 19 p refs
(Contract DAAA21-67-C-0041)
(AD-718868) Avail: NTIS CSCL 11/9

The double torsion technique was employed to determine the fatigue behavior of epoxy resin as it characteristically produces stable crack movement in brittle materials. Preliminary results indicate the existence of an endurance limit which is approximately 60% of the fracture load. The fracture toughness for no crack movement under repeated loading was found. During fatigue testing, there was a 12% increase in both the shear modulus and Youngs modulus. The fracture load also increased about 12%. These two effects may be due to a stress induced cross-linking. Author (GRA)

N71-23390# Naval Ordnance Lab., White Oak, Md.
THE VACUUM THERMAL STABILITY TEST FOR EXPLOSIVES
Herbert T. Simmons, Sr. 28 Oct. 1970 23 p refs
(AD-718806; NOLTR-70-142) Avail: NTIS CSCL 14/2

This report covers a complete description of the methods and procedures used in the vacuum thermal stability test. It describes the construction and assembly of the test chamber, installation of the two heating elements, electronic temperature controller, thermocouple monitoring system, glass sample apparatus, sample tube calibration, and a compatibility test evaluation. Author (GRA)

N71-23392# Naval Ordnance Lab., White Oak, Md.
ULTRASONIC ABSORPTION IN POLYETHYLENE OXIDE
Bruce Hartmann and Jacek Jarzynski 23 Dec. 1970 35 p refs
(AD-718810; NOLTR-70-248) Avail: NTIS CSCL 11/9

Ultrasonic absorption measurements were made on high molecular weight polyethylene oxide from room temperature to above the melting point and from 3 MHz to 11 MHa. No peak in absorption was found at the melting point because the test frequencies were all too high. The absorption that was measured was found to be directly proportional to the degree of crystallinity and to the first power of the frequency. Author (GRA)

N71-23395# Boeing Scientific Research Labs., Seattle, Wash.
TRANSITIONS AND RELAXATIONS IN AROMATIC POLYMERS
Wolfgang Wrasidlo Jan. 1971 45 p refs
(AD-718834; D1-82-1038) Avail: NTIS CSCL 7/4

Transition and relaxation phenomena in twenty-six structurally related polyquinoxalines and other aromatic polymers were studied over a temperature range from 70 to 770K by means of calorimetric, dilatometric, dynamic mechanical and dielectric techniques. Differential thermal analysis and X-ray data showed these polymers to be essentially amorphous. Calorimetric measurements gave discontinuities in heat capacities ranging from 12 to 54 cal/C per mole of repeat unit structures and provided unambiguous assignments of glass transition temperatures of these polymers. Viscoelastic properties were obtained by means of torsional braid analysis and using a longitudinal vibrational apparatus. In a typical case, the dynamic mechanical relaxation spectrum contained three loss maxima. Major mechanical relaxations occurring in the glass transition interval of these polymers are proposed to result from translational motions. Author (GRA)

N71-23402# Aerospace Corp., El Segundo, Calif.
HIGH TEMPERATURE PROPERTIES OF ALUMINUM-GRAPHITE COMPOSITES
John W. Upp, Roger T. Pepper, George E. Kendall, and Ronald C. Rossi 30 Oct. 1970 32 p refs
(Contract F04701-70-C-0059)
(AD-718153; TR-0059(6250-10)-9; SAMSO-TR-70-408) Avail: NTIS CSCL 11/4

High temperature uniaxial tensile tests have been performed on an aluminum matrix - graphite fiber composite material produced by liquid metal infiltration. A slight decrease in the composite fracture stress occurs at temperatures near the melting point of the

matrix. Scanning electron microscope investigations of the fracture surfaces reveal an anomalously brittle high temperature fracture occurring in the matrix. Suggestions are made for possible fracture mechanisms at room and elevated temperatures. Author (GRA)

N71-23440*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
MANUFACTURE AND DELIVERY OF DEMONSTRATION I BEAM FRAMING COMPONENT Final Report, 4 Feb. - 4 Mar. 1971
M. Wexler 4 Mar. 1971 26 p
(Contract NAS8-26754)
(NASA-CR-103098) Avail: NTIS CSCL 11D

An integrally woven, Quartz fiber Omniweave I-Beam, having uniform wall thickness and unequal width caps was successfully woven and molded using epoxy resin 68R as the resin matrix. This part was fabricated solely to demonstrate the capability of the GE-Omniweave Laboratory to produce an integral I-Beam shape. The molded part measured 8 inches in length and an 8 inch unmolded length illustrating the fiber geometry was left attached to the molded beam. Author

N71-23483# Princeton Univ., N.J. Frick Chemical Lab.
MACROSPHERULITES: A NEW SPHERULITIC GROWTH FORM FOR MACROMOLECULES
Courtney Anderson, William J. Toth, and Arthur V. Tobolsky Jan. 1971 33 p refs
(Contract N00014-67-A-0151-0011)
(AD-718420; TR-130) Avail: NTIS CSCL 7/4

The discovery of a new growth form for polyelectrolyte macromolecules giving rise to large unit spherulites is described. Comparison is made with the types of polymer spherulitic behavior previously found. Author (GRA)

N71-23484# Explosives Research and Development Establishment, Waltham Abbey (England).
PERMEABILITY OF POLYMERS TO ORGANIC FLUIDS, PART 1
A. L. Stokoe and K. J. Ledbury Feb. 1970 19 p refs
(ERDE-TR-18-Pt-1) Avail: NTIS

An improved permeability apparatus has been developed and compared with previous types. The new apparatus overcomes most of the disadvantages of the older types and is shown to give consistent results. The qualitative effects of certain variables including temperature, and a method of calculating permeabilities have been assessed. A standard test fluid consisting of 30:70 v/v toluene/isooctane was used to permeate nitrile rubbers, polythene, and neoprenes. Author (ESRO)

N71-23583# Princeton Univ., N.J. Frick Chemical Lab.
STUDIES ON THE STRESS RELAXATION OF POLYSTYRENES IN THE RUBBERY FLOW REGION
W. Knoff, I. L. Hopkins and A. V. Tobolsky Jan. 1971 22 p refs
(Contract N00014-67-A-0151-0011)
(AD-718363; ONR-TR-RLT-129) Avail: NTIS CSCL 11/9

An empirical equation for stress relaxation in the rubbery-flow region was applied to broad- and narrow-distribution polystyrenes. It is shown that over the range of polydispersity and molecular weights tested, the shear viscosity eta state near compliance J(e), and the rubbery-flow stress relaxation may be predicted if M(n) and M(w) are known. Author (GRA)

N71-23619# Aerospace Corp., El Segundo, Calif. Lab. Operations.
DEVELOPMENT OF AN ALUMINUM-GRAPHITE COMPOSITE Technical Report, Jul. 1969 - Mar. 1970
Roger T. Pepper, Ronald C. Rossi, John W. Upp, and William C. Riley 30 Aug. 1970 35 p refs
(Contract F04701-70-C-0059)
(AD-718409; TR-0059(9250-03)-1; SAMSO-TR-70-301) Avail: NTIS CSCL 11/4

A composite consisting of an aluminum alloy matrix and a graphite fiber reinforcement was developed with strengths exceeding the rule of mixture strength of 101 ksi. The composite is not degraded by temperature to 550C or by thermal cycling from −193 to +500C. The importance of various processing techniques to the successful development of this composite and the effects of certain process variables on properties are discussed. Author (GRA)

N71-23620# Naval Research Lab., Washington, D.C.
CHEMISTRY AND PHYSICS OF GLASS Semiannual Report, Period Ending 31 Dec. 1970
C. C. Klick 31 Dec. 1970 27 p refs
(ARPA Order 418)
(AD-718839; SAR-7) Avail: NTIS CSCL 11/2

The report describes work done in areas of glass science. X-ray and neutron diffraction studies have demonstrated a degree of ordering in glassy SiO_2, while experimental and theoretical studies of radiation-induced defects in this important material have been advanced considerably. The first observation has been made of free carrier optical absorption in semiconducting chalcogenide glasses and the existence of a new fundamental defect center in alkali borate glasses has been confirmed. A potential new laser glass has been formulated and optimized with respect to immunity from platinum contamination; efforts to prepare and test large batches have been initiated. Author (GRA)

N71-23625# Air Force Systems Command, Wright-Patterson AFB, Ohio. Materials Lab.
AIR FORCE MATERIALS SYMPOSIUM 1970. TECHNICAL SPECIALIST SESSIONS. SUMMARY ABSTRACTS
22 May 1970 101 p Conf. held at Miami Beach, Fla., 18-22 May 1970
(AD-718432) Avail: NTIS CSCL 11/6

The document contains the 100-word abstracts of all the papers presented in the Technical Specialist Sessions of the Air Force Materials Symposium 70 held in Miami Beach, Florida on 18-22 May 1970. Author (GRA)

N71-23658* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INSULATION SYSTEM Patent
Porter J. Perkins, Jr., inventor (to NASA) Issued 16 Jul. 1968 (Filed 3 Feb. 1965) 4 p Cl. 220-9
(NASA-Case-XLE-02647; US-Patent-3,392,864; US-Patent-Appl-SN-430226) Avail: US Patent Office CSCL 11D

Insulation is described for cryogenic materials comprising sheets of light weight plastic foam. A positive airtight seal covers the foam to ensure that the basic conductivity will not be degraded by any fluid that is cryopumped into the insulation. Official Gazette of the U.S. Patent Office

N71-23671# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PREPARATION OF ADDITIVES CONTAINING PHOSPHORUS, SULFUR, AND CHLORINE FROM THIO ETHERS OF GLYCEROL MONOCHLOROHYDRIN
A. M. Kuliev et al 25 Nov. 1970 10 p refs Transl. into ENGLISH from Prisadki k Mazochnym Maslam (USSR), no. 2, 1969 p 57-62
(AD-718693; FTD-HT-23-713-70) Avail: NTIS CSCL 11/8

A number of phosphites and thiophosphates based on alkyl sulfides were obtained. It was established that the synthesized

thiophosphates are more effective antiwear additives than the phosphites. It was shown that the investigated phosphites and thiophosphates significantly reduce the corrosion aggressiveness of transmission oils. Author (GRA)

N71-23672# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

POLARIZATION PHENOMENA IN A DIELECTRIC STRUCTURE OF TITANIUM-TITANIUM DIOXIDE-METAL

S. A. Akulinin et al 19 Nov. 1970 11 p refs Transl. into ENGLISH from Proc. of Relaksatsionnye Yavleniya V Tverd. Telakh, 4th Vsesoyuznoi Nauchn. Konf., Voronezh, 1965 (Moscow), 1968 p 634–637

(AD-717893; FTD-HT-23-568-70) Avail: NTIS CSCL 11/7

Typical measurements of the time dependence on the depolarization current show damping of the current through the specimens subjected to anodic polarization. The relations for anodic and cathodic polarization show that the abs. value of the drop in the current after cathodic polarization is always lower than that after anodic polarization. Moreover, the depolarization current after cathodic dislocation disclosed an inversion in the direction flow. Depolarization current in mech. polished specimens were larger than in unpolished specimens. This is attributed to the fact that the oxide film has a more definite structure and consequently contains an appreciable no. of inhomogeneities responsible for the formation of space charges. Author (GRA)

N71-23673# Solar, San Diego, Calif.

TUNGSTEN REINFORCED OXIDATION RESISTANT COLUMBIUM ALLOYS Final Report, 1 Nov. 1969–1 Nov. 1970

M. J. Klein, A. G. Metcalfe, and R. B. Domes Nov. 1970 78 p refs

(Contract N00019-69-C-0137)

(AD-717969; RDR-1635-8; SOLAR-R-P-6-3113-7) Avail: NTIS CSCL 11/4

The approach used in this investigation was to combine weak but oxidation resistant matrices with high-strength filaments to produce a composite with oxidation resistance under loads at temperatures above 2000F. These operating temperature and strength goals are needed for gas turbine engines, but are beyond the range of nickel- and cobalt-base superalloys which have maximum temperature capabilities of about 1900F. Ideally, the composite material could be used uncoated but could also serve as a fail-safe material when coated. During the period covered by this report (the second year) characterization of the mechanical properties, oxidation resistance and filament-matrix compatibility of the model system was continued. Author (GRA)

N71-23706# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INCREASING THE QUALITY OF LUBRICATING GREASE BY APPLICATION OF COMPOSITIONS OF CERTAIN ADDITIVES CONTAINING SULFUR AND PHOSPHORUS

R. K. Velieva et al 4 Dec. 1970 11 p refs Transl. into ENGLISH from Azerb. Neft. Khoz. (Baku), v. 48, no. 9, 1969 p 39–41

(AD-718484; FTD-HT-23-746-70) Avail: NTIS CSCL 11/6

Additives were prepared from mixtures of diaryl dithiophosphates and triaryl dithiophosphates, obtained by reaction of P2S5 with alkylphenols (I) or methylenebis(alkylphenols) (II). Each of the di- and triester mixtures obtained from I and II was reacted with vinyl acetate and with CH2CMeCO2Me to give a total of 12 additives with surface-active properties. The inhibiting effect of 3% of each additive in greases on corrosion in neutral electrolytes was determined by the inhibition of the cathodic or anodic processes on metal. None of the additives had a significant thickening effect on the grease (Petrolatum), but increased the continuity of the grease film. The additives were efficient inhibitors of cathodic corrosion for the grease in sea water. Some of the additives also had an important inhibiting effect on the anode process. Author (GRA)

N71-23710* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

SELF-LUBRICATING FLUORIDE METAL COMPOSITE MATERIALS Patent

Harold E. Sliney, inventor (to NASA) Issued 31 Dec. 1968 (Filed 1 May 1967) 4 p Cl. 29-182.1

(NASA-Case-XLE-08511; US-Patent-3,419,363; US-Patent-Appl-SN-635972) Avail: US Patent Office CSCL 11D

A self lubricating bearing and sealing material for use in a chemically reactive environment is investigated. A porous metal is impregnated with barium fluoride-calcium fluoride eutectic for use in g high temperature applications.

Official Gazette of the U.S. Patent Office

N71-23765# Drexel Univ., Philadelphia, Pa. Dept. of Metallurgical Engineering.

DEFORMATION AND FRACTURE IN Al-Cu-Al2 EUTECTIC COMPOSITES

A. Pattnaik and A. Lawley Jan. 1971 29 p refs

(Contract N00014-67-A-0406-0001)

(AD-718360; TR-5) Avail: NTIS CSCL 11/4

Ambient temperature compressive stress-strain behavior to failure, and associated structural detail, have been characterized in Al-CuAl2 composites of small interlamellar spacing. Differences in the compressive and tensile yield stress levels of the composite are attributed to thermally induced residual stress. Analysis gives a residual tensile stress of approximately 3500 psi and an in-situ yield stress of approximately 13,500 psi in the aluminum rich phase. Evidence for a dislocation-interface interaction is provided by the form of deformation substructure in the aluminum rich phase. Failure in these multi-grained eutectic composites is shown to be controlled primarily by shear-mode buckling of the lamellar structure. Buckling leads to cleavage of the CuA12 phase, shear in the aluminum-rich phase, accompanied by void formation, coalescence and crack formation. Author (GRA)

N71-23766# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SPECIFIC WEAR OF TOOLS DURING CUTTING OF POROUS CERMET MATERIALS

V. I. Kononenko 30 Oct. 1970 13 p refs Transl. into ENGLISH from the Russian

(AD-718488; FTD-HT-23-440-70) Avail: NTIS CSCL 13/9

The roles were studied for the wear of tools during the treatment of porous materials, and requirements were set up for new tool materials. Author (GRA)

N71-23767# Rensselaer Polytechnic Inst., Troy, N.Y. Materials Engineering Div.

SEMI-CONDUCTION AND ELECTRON HOPPING IN VITREOUS SYSTEMS: MAGNETIC PROPERTIES, MICRO-STRUCTURE, AND ULTRA-STRUCTURE OF PARTIALLY CRYSTALLIZED B2O3-BaO-Fe2O3 GLASS Annual Technical Report, 1 Jan. 1970–1 Jan. 1971

Mohammed Fahmy, Mann J. Park, Minoru Tomozawa, and Robert K. Mac Crone Jan. 1971 44 p refs

(Contract N00014-67-A-0117-0008)

(AD-718829; RPI-404.09-TR-2) Avail: NTIS CSCL 20/12

The crystallisation products and morphology of a 68B2O3 - 17 BaO - 15 Fe2O3 mole % glass have been studied using magnetisation measurements, small angle x-ray scattering measurements and replica electron microscopy. The glasses containing the crystallised phases were super-paramagnetic down to 77 degrees K, and the magnetisation curves are analysed in terms

of a bimodal distribution of magnetic moments. The SAXS and electron micrographs confirmed the bimodal distribution of particle sizes, and a very precise correlation between magnetic properties and microstructure is obtained. By quantitative calculations, it is shown that the precipitate phases themselves are complex in structure, and most likely consist of an inner ferrimagnetic core surrounded by an anti-ferromagnetic grape-fruit skin. This structure for the precipitates is confirmed directly by electron microscope observations. Author (GRA)

N71-23768# Virginia Polytechnic Inst., Blacksburg. Dept. of Engineering Mechanics.
INCREASE OF TECHNICAL STRENGTH OF MECHANICALLY GRIPPED FIBERGLAS. PROJECT THEMIS
K. Reifsnider and C. Kelley Feb. 1971 67 p refs
(Contract DAAF07-69-C-0444)
(AD-718252; VPI-E-71-6) Avail: NTIS CSCL 11/4

Epoxy-matrix fiberglas rods were pulled to fracture in simple tension using standard conical chuck cable grips with serrated gripping surfaces. Failure of the rods always initiated in the grip area. A number of specimens was soaked in a special solution for a short period of time prior to testing. The technical strength of the treated specimens was from 10-15% greater than the untreated ones. The increased toughness and ductility of the treated surface is thought to blunt the stress distribution by material flow in the areas of concentration created by the mechanical grips. In particular, the initiation and propagation of cracks is inhibited by this solution softening of the gripped surface area. Author (GRA)

N71-23769# Miami Univ., Oxford, Ohio. Dept. of Chemistry.
CHEMICAL, STRUCTURAL AND ANALYTICAL RESEARCH Annual Summary Report, 17 Aug. 1969 – 31 Aug. 1970
J. E. Katon Wright-Patterson AFB, Ohio AFML Dec. 1970 39 p refs
(Contract F33615-70-C-1021)
(AD-718431; AFML-TR-70-270) Avail: NTIS CSCL 7/4

The report summarizes the research programs and service functions covering determination of molecular structures, characterization of materials and development and application of analytical techniques of various kinds. The contract also involves various services supplied the Air Force in support of their in-house programs. The major areas of research were in emission spectrometry, mass spectrometry and vibrational spectroscopy. In emission spectrometry the major effort was directed toward studies of electromagnetic arc stabilization. The vibrational spectroscopic studies were concentrated on spectral behavior of halogenated organic acids and possible correlations with structure. In the area of mass spectrometry efforts were expended on modification of the mass spectrometer for appearance potential measurements, the development of a photo plate method for mass measurement and mass spectra-structure investigations of polyfluoroaromatic compounds and polychlorinated ferrocenes. Author (GRA)

N71-23794# Purdue Univ., Lafayette, Ind.
MATERIALS SCIENCE RESEARCH Progress Report, 1 Oct. 1969 – 30 Sep. 1970
1 Dec. 1970 213 p refs
(Contracts DAHC5-69-C-0213; ARPA SD-102)
(AD-718821; PR-9) Avail: NTIS CSCL 11/7

Summaries of research in the following areas are given: Analytical determinations; Trace element studies; Bonding and bond structure; Composites catalysts and polymers; Crystal growth; Radiation damage; Diffusion studies; Electrodynamics and transport phenomena; Electronic properties of materials; Elementary excitations and interactions; Glasses and amorphous materials; Impurities in materials; Ionic crystals; Kinetic processes; Magnetic properties and magnetic materials; Metals, metallurgical properties; Metals, transport, and optical properties; Properties of oxides; Semiconductor, optical properties and resonance phenonema; Semiconductor, transport properties; Studies of solutions, fused salts and solid solutions; Superconductivity and allied phenomena; Thermal properties of materials; Thermodynamics properties of materials; X-ray investigations; and Pressure and shock effects. GRA

N71-23806# RAND Corp., Santa Monica, Calif.
WAVE PROPAGATION IN A COMPOSITE MATERIAL CONTAINING DISPERSED RIGID SPHERICAL INCLUSIONS
F. C. Moon and C. C. Mow Dec. 1970 33 p refs
(Contract F44620-67-C-0045; Proj. RAND)
(AD-718087; RM-6139-PR) Avail: NTIS CSCL 11/4

A dynamic model is presented concerning the effects of stress waves on composite materials with rigid spheres in an elastic matrix, such as plastics with small particle fillers to increase stiffness and sound absorption, or metal solutions that separate during solidification into, say, steel-carbide spheroids in a ferrite matrix. In a dilute suspension with randomly distributed particles, multiple interactions between inclusions can be neglected; and the dispersion and attenuation of waves in the medium can be found in terms of the local scattering processes at each inclusion. Coupled equations of motion for both matrix and inclusions were derived through a variational technique. Results show the well-known fourth-power dependence of attenuation on frequency. As the dynamics of wave scattering introduce inertia affects not explained by the mass and diameter of the inclusions alone, a constitutive equation involving the velocities must be specified. Author (GRA)

N71-23950*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PENDULUM IMPACT RESISTANCE OF TUNGSTEN FIBER METAL MATRIX COMPOSITES
Edward A. Winsa and Donald W. Petrasek [1971] 20 p refs Presented at the 2d Conf. on Composite Mater.: Testing and Design, Anaheim, Calif., 20 – 22 Apr. 1971; sponsored by the Am. Soc. for Testing and Mater.
(NASA-TM-X-67810) Avail: NTIS CSCL 11D

The impact properties of pure copper, copper-nickel alloy, and superalloy matricies reinforced with tungsten fibers were studied. The following increased composite impact strength: (1) increased fiber or matrix toughness; (2) increased test temperature; (3) hot working and heat treatment; and (4) decreased fiber-matrix reaction. Increasing fiber content increased impact strength above fiber ductile - brittle transition temperature (DBTT), but lowered it below fiber DBTT. Notch sensitivity was reduced by increasing fiber and/or matrix toughness. Above 533 K (fiber DBTT), the superalloy matrix composite had better impact strength than a turbine blade superalloy. Below 533 K the composite and superalloy were equivalent. Author

N71-23961# Utah Univ., Salt Lake City. Div. of Materials Science and Engineering.
IMPURITY EFFECTS ON THE CREEP OF POLYCRYSTALLINE MAGNESIUM AND ALUMINUM OXIDES AT ELEVATED TEMPERATURES Technical Progress Report, 19 Dec. 1969 – 18 Dec. 1970
Ronald S. Gordon 1970 85 p refs
(Contract AT(11-1)-1591)
(COO-1591-3; UTEC-MSE-70-211) Avail: NTIS

The creep of iron doped polycrystalline magnesium oxide and iron and chromium doped polycrystalline aluminum oxide between 1300 and 1550 C is discussed. The creep of iron coped MgO is viscous and very sensitive to changes in the oxygen partial pressure. With decreasing O2 partial pressure the creep rate decreases and the creep activation energy increases. However, in iron doped Al2O3 the creep rate increases and the creep activation

energy decreased with decreasing O2 partial pressure. Possible mechanisms to explain these effects are discussed. The creep of iron and chromium doped Al2O3 is nonviscous with a creep exponent of 1.3. The creep of chromium doped Al2O3 is insensitive to changes in oxygen partial pressure. Transient creep in MgO-Fe2O3 solid solutions is analyzed in terms of two concurrent mechanisms: 1) An exponential (partially recoverable) viscoelastic decay process which can be described by a Kelvin solid, and 2) steady state creep which will show transient behavior if simultaneous grain growth is occurring. Anelastic grain boundary sliding is tentatively proposed as the mechanism for the exponential decay process. Author

N71-23952# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

PREPARATION AND INVESTIGATION OF ADDITIVES CONTAINING PHOSPHORUS, NITROGEN, AND BORON

A. M. Kuliev et al 25 Nov. 1970 8 p Transl. into ENGLISH from Prisadki Smaz. Maslam (USSR), no. 2, 1969 p 77–79
(AD-717895; FTD-HT-23-714-70) Avail: NTIS CSCL 11/8

Ash-free organic compounds containing phosphorus, nitrogen, and boron were prepared and the possibility of their use as antioxidation additives for lubricating oils was demonstrated. Author (GRA)

N71-24010*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.

IMPACT RESISTANCE OF UNIDIRECTIONAL FIBER COMPOSITES

C. C. Chamis, M. R. Hanson, and T. T. Serafini [1971] 37 p refs Presented at the 2d Conf. on Composite Mater.: Testing and Design, Anaheim, Calif., 20–22 Apr. 1971; sponsored by Am. Soc. for Testing and Mater.
(NASA-TM-X-67802) Avail: NTIS CSCL 11D

Composite micromechanics and macromechanics and the miniature Izod impact test were used to investigate the impact resistance of unidirectional composites. Several composite systems were examined both theoretically and experimentally. The composites are classified theoretically relative to their impact resistance for longitudinal, transverse and shear modes. Experimental results are reported only for Izod impact with the fibers either parallel or transverse to the cantilever longitudinal axis. Impact resistance design criteria which evolved during this investigation are used to design hybrid composites with improved impact resistance. The results show that in-situ fiber and matrix elongation-to-fracture, matrix modulus, fabrication process, fiber and void volume ratios, and microresidual stresses are variables which affect the impact resistance. The ranking of composite impact resistance on the basis of measured and predicted results was in excellent agreement. Author

N71-24013# Interand Corp., Rockville, Md.

THE HIGH DRIVE PROPERTIES OF A NEW COMPOSITE CERAMIC PIEZOELECTRIC TRANSDUCER MATERIAL

William W. Lester 28 Dec. 1970 50 p refs
(Contract N00014-70-C-0182)
(AD-718387; IW69-20-TM-2U) Avail: NTIS CSCL 9/1

The properties under high drive conditions of disc specimens of whisker reinforced composite ceramics are compared with the similar properties of commercially available non-reinforced ceramics of the same general family. The ceramics are of the lead zirconate titanate type, with the whisker content of two grades of alpha alumina (sapphire) in five weight per cent amount. Observations are made of stress, strain, electric field, resonant frequency, modulus, and electrical impedance. It is found that the whisker reinforced materials exhibit good linearity of stress, strain, resonant frequency, and modulus at high drive when compared with commercial samples of the same family, which are often markedly nonlinear. The conclusion is drawn that specimens, even of soft type ceramic, when whisker reinforced, are made hard in many of their properties. Author (GRA)

N71-24094# Clevite Corp., Cleveland, Ohio. Electronic Research Div.

DISPERSION STUDY OF DOMAIN WALL MOBILITY AND MECHANICAL DAMPING IN Pb(Ti, Zr)O3 TRANSDUCER CERAMICS Final Technical Report, 1 Dec. 1968–1 Dec. 1970

Helmut H. A. Krueger 21 Jan. 1971 59 p refs
(Contract N00014-69-C-0046)
(AD-717964) Avail: NTIS CSCL 20/12

Resonant methods were used to measure the properties of Pb(Zr, Ti)O3 ceramics, emphasizing mechanical Q, over the temperature rang –180 degrees C to +165 degrees C, with specimens whose dimensions were chosen to give a frequency range of about 60 kHz to about 850 kHz. The relationships between loss 1/(Q sub M) maxima and minima and possible loss mechanisms are discussed. This temperature dropoff in Q sub M is attributed to increasing conductivity, while increased losses at low temperatures are tentatively ascribed to a phase transition. Some work is also described on quasistatic strain vs. stress measurements. Author (GRA)

N71-24095 Rutgers Univ., New Brunswick, N.J.

IMPROVEMENT OF THE STRUCTURAL SOUNDNESS OF FUSED CAST ALUMINA

Richard Gary Labar (Ph.D. Thesis) 1969 148 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 70-10082

Traditionally, fusion-casting produces ceramics which are characterized by high density, hardness, resistance to corrosion and abrasion and structures which are unsound. The objective of this study was to determine the principles of the fusion-casting process as they apply to the production of structurally sound fused-cast alumina articles. To attain this objective, the problems encountered in melting and casting refractor oxide compositions were investigated. This was achieved by the development of suitable furnace designs, operating, casting and annealing procedures. Further, these process controls were used to evaluate the effect of chemical additions on grain size, intergranular bonding and formation of microstructures unique to fused-casting. The attainment of structurally sound fused-cast alumina resulted from utilization of the most suitable system of process controls and furnace design in conjunction with optimum grain refinement and intergranular bonding, development of metastable solid solutions and strengthening by precipitation of solute rich phases. Dissert. Abstr.

N71-24123 Rutgers Univ., New Brunswick, N.J.

AN EXPERIMENTALLY SUPPORTED MATHEMATICAL MODEL OF THE Na2O-SiO2 GLASS SYSTEM

Robert Larry Nacamu (Ph.D. Thesis) 1970 258 p
Avail: Univ. Microfilms: HC $11.70/Microfilm $3.35 Order No. 70-10090

A model for the soda silica glass system based on division of the structure into ions categorized by the number and type of immediate neighbors is offered. By assigning energies to each type of ion with given surroundings, a model is formulated from which a free energy expression based on entropy and internal energy calculations is obtained. This free energy expression is then minimized as a function of temperature and composition, yielding the associated distribution of coordinations. From this distribution the molar volume of the glass is calculated from a geometrically approximated assignment of volume to each type of ion with a given set of neighbors. The calculated molar volume was compared to molar volumes experimentally obtained from quenched samples of soda-silica glasses. Dissert. Abstr.

N71-24124 Rutgers Univ., New Brunswick, N.J.
THE EFFECTS OF HIGH ELECTRIC FIELDS ON MODIFIED LEAD ZIRCONATE-LEAD TITANATE CERAMICS FOR PIEZOELECTRIC APPLICATIONS
Jeffrey Harwood Belding (Ph.D. Thesis) 1969 147 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 70-10046

The power handling ability of adulterated lead zirconate-lead titanate piezoelectric ceramics was compared on the basis of their ability to produce a maximum amount of acoustic radiation power. These measured properties were dielectric constant, electric loss tangent, piezoelectric coupling coefficient, mechanical quality factor, and mechanical compliance. These parameters were measured as a function of electric field, dynamic stress, and temperature. Several of the most promising lead zirconate-lead titanate compositional modifications were fabricated. The ultimate classification of these compositions with respect to their power handling ability revealed Sr(2+) or Ca(2+) substitutes for Pb(2+) with simultaneous substitution of Fe(3+) for Zr(4+) and Ti(4+) as most beneficial. Dissert. Abstr.

N71-24125 Rutgers Univ., New Brunswick, N.J.
OPACITY AND OPAQUE GLAZES BASED ON LIQUID IMMISCIBILITY IN THE LEAD BOROSILICATE SYSTEM
Andre Paul Galliath (Ph.D. Thesis) 1969 177 p
Avail: Univ. Microfilms: HC $8.20/Microfilm $3.00 Order No. 70-10066

Opacity data obtained for phase separated glasses in the lead borosilicate system were used to develop white opaque glazes based on liquid immiscibility. An area of most opaque glasses at the low B2O3 side of the immisicibility dome was determined, and compositions within this area were used for detailed opacity versus composition studies. The effects of alumina, alkali and RO substitutes were investigated. The results showed how the tolerance for homogenizers can be increased and white glasses maintained regardless of the homogenizers by the substitution of RO oxides for PbO. The microstructures of many of these glasses were studied and related to the opacity. The effects of thermal treatments and composition on the phase separation were also investigated. Dissert. Abstr.

N71-24183* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ALKALI METAL SILICATE PROTECTIVE COATING Patent
John B. Schutt and Charles M. Shai, inventors (to NASA) Issued 17 Dec. 1968 (Filed 3 May 1965) 3 p Cl. 106-84
(NASA-Case-XGS-04799; US-Patent-3,416,939; US-Patent-Appl-SN-452944) Avail: US Patent Office CSCL 11C

An inorganic paint composition and method for processing same have been developed in which the composition is particularly resistant to ultra violet radiation. The constituents include an alkali metal silicate solution vehicle and aluminum oxide as a pigment and filler. The applicability of the paint is enhanced by the addition of potassium hydroxide to increase its flexibility and boric acid and/or zinc oxide to increase its hardness. The paint is formed by merely stirring the resulting mixture for a time depending on the quality desired of the paint. In addition, the time of processing can be shortened by the application of heat. Official Gazette of the U.S. Patent Office

N71-24184* Hughes Aircraft Co., Culver City, Calif.
INORGANIC THERMAL CONTROL PIGMENT Patent
George Richard Blair, inventor (to NASA) Issued 25 Mar. 1969 (Filed 5 Feb. 1965) 3 p Cl. 106-84; Int. Cl. C09d1/02, 5/32 Sponsored by NASA
(NASA-Case-XNP-02139; US-Patent-3,434,855; US-Patent-Appl-SN-430777) Avail: US Patent Office CSCL 11C

A novel heat-treated clay composition was produced by heating an impurity containing aluminum silicate clay having the following weight percentages: 42–48, SiO2; 38–40, Al2O3; 1.0–0.1, Fe2O3; <2, MgO; 0.2–0.8, TiO2; and <1.0, CaO, Na2O, K2O (combined) in the form of a thin layer at a temperature of from about 1175 C. to about 1375 C. The ultraviolet light stable paint composition contained this heated-treated clay together with an alkali metal silicate. Official Gazette of the U.S. Patent Office

N71-24185 Rutgers Univ., New Brunswick, N.J.
THE DEVELOPMENT OF HIGH DIELECTRIC CONSTANT, TEMPERATURE STABLE FERROELECTRIC COMPOSITES IN THE SrSnO3-BaTiO3 SYSTEM
William Anson Belding (Ph.D. Thesis) 1969 137 p
Avail: Univ. Microfilms: HC $8.60/Microfilm $3.00 Order No. 70-10047

Several approaches are used to achieve temperature stability of dielectric constant in ferroelectric materials over a significant temperature range. By combining two end members, each with different temperature dependence of dielectric constant, it is possible to achieve a relatively temperature independent ceramic. Suitable end members are BaTiO3 materials with differing amounts of SrSnO3 as a shifting additive. Where interaction between end members is controlled or eliminated, temperature stable ferroelectric composites are realized. Dissert. Abstr.

N71-24239# Ballistic Research Labs., Aberdeen Proving Ground, Md.
THE DIELECTRIC CONSTANT OF POLYETHYLENE UNDER SHOCK COMPRESSION
George E. Hauver Dec. 1970 33 p refs
(AD-718033; BRL-1520) Avail: NTIS CSCL 20/3

The dielectric constant of high-density polyethylene was measured under shock compression in the pressure range from 16 to 246 kilobars. A charged-capacitor technique was used, and the dielectric constant was calculated from the charging current measured during shock compression. From 36 to 246 kilobars, the dielectric constant was found to increase according to the Drude equation, assuming constant polarizability and in this pressure range it was represented by the relationship k - 1 = 1.47 rho, where rho is the density. Author (GRA)

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

N71-23218*# Notre Dame Univ., Ind. Dept. of Electrical Engineering.
NOTE ON ARITHMETIC CODES AND ARITHMETIC DISTANCE
William F. Hartman Nov. 1970 12 p refs
(Grant NGL-15-004-026)
(NASA-CR-117884; EE-705) Avail: NTIS CSCL 12A

Some observations are presented on cyclic arithmetic codes and their distance properties. The main result is the demonstration that modular arithmetic weight is invariant to cyclic shifts of code words. It is shown that the minimum distance of a cyclic arithmetic code can be found by a search of less than one-sixth of the codewords. A simple proof is given of a result for computation of arithmetic weights in terms of the residue classes modulo 8, the number of codewords. Author

N71-23219*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INCLUSION OF AERODYNAMIC DRAG IN VINTI'S SATELLITE THEORY

Stan Watson and N. L. Bonavito Mar. 1970 95 p refs
(NASA-TM-X-65487; X-550-70-90) Avail: NTIS CSCL 12A

In order to achieve separability in the Vinti theory of earth satellite motion when a nonconservative force such as air drag is considered, it is necessary to introduce a set of variational equations for the orbital elements, expressed as functions of the orbital elements and the tangential, radial, and normal components of the nonconservative forces acting on the system. The presence of a velocity dependent potential no longer allows the Hamiltonian to be the total energy, and furthermore, this term is cubic in the velocity. The Hamiltonian is preserved in form, and remains as the total energy but the initial conditions and hence the Jacob constants of the motion are changed with time through the variational equations. Separability is achieved at each point in time corresponding to continuously changing generalized coordinates in phase space. Some initial results of application of the program to the heavy air drag satellite San Marco 2, show improvement in the accuracy of the computer orbits. Author

N71-23220*# Brown Univ., Providence, R.I. Center for Dynamical Systems.

NECESSARY CONDITIONS FOR CONTINUOUS PARAMETER STOCHASTIC OPTIMIZATION PROBLEMS

H. J. Kushner [1970] 34 p refs
(Grants NGL-40-002-015; NSF GK-2788; AF-AFOSR-693-67B)
(NASA-CR-117886) Avail: NTIS CSCL 12A

The abstract variational theory of Neustadt is applied to obtain a stochastic maximum principle which is able to handle greater varieties of state space constraints. The problem formulation and mathematical background are given as well as a required result of Neustadt. Linearized equations and the maximum principle are outlined for the open loop case. A specific convex cone is derived and extensions of the theory are discussed. J.M.

N71-23224# Washington Univ., Seattle. Dept. of Mathematics.

NUMERICAL ANALYSIS WITH APPLICATION TO AEROSPACE SYSTEMS Final Scientific Report, 1 Jul. 1969 – 30 Jun. 1970

A. A. Goldstein Jan. 1971 22 p refs
(Grant AF-AFOSR-1846-70)
(AD-717874; AFOSR-70-3004TR) Avail: NTIS CSCL 12/1

The report covers work in the areas of Inverse Functions, on descent from local minima of functions, and a note on the Mean Value Theorem. Author (GRA)

N71-23348# Aerospace Research Labs., Wright-Patterson AFB, Ohio.

ON FREDHOLM TRANSFORMATIONS IN YEH-WIENER SPACE Final Report

Chull Park Nov. 1970 34 p refs
(AD-718425; ARL-70-0269) Avail: NTIS CSCL 12/1

Let C sub Y denote the Yeh-Wiener space, i.e., the space of all real-valued continuous functions f(x,y) on (I sup 2) identically equal to (0,1) X (0,1) such that f(0,y) = f(x,0) identically equal to 0, and a Gaussian measure defined on it so that the expected value E(f(x,y)) = 0 and the covariance E(f(s,t)f(x,y)) = (1/2)min(s,x)min(t,y). Consider the Fredholm transformations of the type T(f(xy)) = f(x,y) + the integral I sup 2 of K(x,y,s,t)f(s,t)dsdt of C sub y onto C sub y. Under suitable assumptions on the kernel K(x,y,s,t) the author gives the corresponding Radon-Nikodym derivatives. The author hopes the result will help for the evaluation of numerous Yeh-Wiener integrals of exponential functionals. Author (GRA)

N71-23349# California Univ., Los Angeles. School of Engineering and Applied Science.

ON THE GLOBAL OBSERVABILITY OF NONLINEAR SYSTEMS

John Murray Fitts (Ph.D. Thesis) 1970 195 p refs
(Grant AF-AFOSR-1328-67)
(AD-718141; AFOSR-TR-71-0141) Avail: NTIS CSCL 12/1

Some mathematical preliminaries and notations are presented along with a discussion relating the observability of continuous time systems to inverse function theory. Several lemmas are presented which give conditions on the Jacobian matrix J(x) of the nonlinear map H(·) which are sufficient to show its univalence on a domain Omega sub zero. These lemmas are based on the intuitive concept that a line segment in Omega sub zero maps into a nonintersecting curve in H(Omega sub zero). Inverse function theorems are related to the existence and uniqueness of a solution of a particular ordinary differential equation. The question of what class of nonlinear maps from Omega sub zero to H(Omega sub zero) have an unique inverse if and only if the Jacobian matrix J(x) has rank n for all x epsilon Omega sub zero is determined. A contraction mapping on the domain Omega sub zero under some quite general conditions is outlined. The case is studied where the measurements are corrupted by noise as well as other topics such as convergence rates and current state estimation. A nonlinear filtering algorithm is presented which is related to some of the deterministic iterative methods. Conclusions and problem areas are summarized along with areas of future research. Author

N71-23436# Texas A&M Univ., College Station. Inst. of Statistics.

A NOTE ON THE OPTIMUM SPACING OF SAMPLE QUANTILES FROM THE SIX EXTREME VALUE DISTRIBUTIONS. Project Themis

Gunnar Kulldorff Jan. 1971 16 p refs
(Contract N00014-68-A-0140)
(AD-718836; THEMIS-TR-26) Avail: NTIS CSCL 12/1

The extreme value distributions have many fields of application, including floods, wind speeds, earthquakes, aeronautics, naval engineering, corrosion and strength of materials. This paper deals with the estimation of an unknown location or scale parameter of an extreme value distribution by using only a few sample quantiles. Such methods are often convenient in testing procedures. The paper is particularly concerned with the optimum selection of sample quantiles from a large sample. It is shown that the problems of asymptotically optimum spacing of sample quantiles in connection with asymptotically best linear unbiased estimation of the location parameter of an extreme value distribution of Type 1 or the scale parameter of an extreme value distribution of Type 2 or 3, are essentially the same. Previous results for the scale parameter of an exponential distribution can therefore be used also for the extreme value distributions. Author (GRA)

N71-23447# Technische Hogeschool, Delft (Netherlands). Afdeling der Technische Natuurkunde.

SOME CONSIDERATIONS ON BINARY CODE SYMBOL TRANSFORMATION [ENIGE BESCHOUWINGEN OVER HET TRANSFORMEREN VAN BINAIRE CODETEKENS]

Jacob Christoffel Joosten (Ph.D. Thesis) May 1969 297 p refs In DUTCH
Avail: NTIS

Partitions of the set of all n-position code symbols, induced by equivalence relations defined by a set of transformations, were considered. The classes, quotient set, and the full representation system of the group with the cyclic transformation as a generator were rings, consisting of a set of code symbols cyclically transferred from one particular code symbol. ESRO

N71-23532# Technische Hogeschool, Delft (Netherlands). Afdeling der Elektrotechniek.

THE GROUP OF NEAT EXTENSIONS

Marius Johannes Schoeman (Ph.D. Thesis) Oct. 1970 54 p

refs Sponsored jointly by South-African Sci. and Ind. Res. Council and Pretoria Univ.
Avail: NTIS

The concept of neatness of subgroups, which is a natural generalization of purity, is surveyed and discussed together with the extension problem of neat groups which is studied by factor sets. The class of groups whose pure extensions by torsion groups are splitting is also examined. It is found that the study of neat subgroups is important in defining the structure of these cotorsion groups. The study is limited to additive Abelian groups. ESRO

N71-23576# George Washington Univ., Washington, D.C.
SCHEDULING, SEQUENCING AND NETWORKS
Fred D. Rigby 11 Jan. 1971 51 p
(Contract N00014-67-A-0214)
(AD-717943; T-243) Avail: NTIS CSCL 12/2

An optimal scheduling problem type of some generality is examined and found to possess an essential structure very similar to that of jobshop sequencing. It is also found to be, in essence, a simple but not quite ordinary network flow programming problem in which link capacities must be discovered during a solution process. This fact is exploited in the development of an optimal scheduling algorithm that minimizes total operation duration and takes advantage of the forward-backward symmetry inherent in scheduling (or sequencing) of the kind considered. No significant departure from the usual enumeration character of optimal sequencing algorithms is attained, though abbreviated enumeration is sought with some success. Indeed, one effect of the network analogy is to suggest that improvement over carefully managed enumeration in scheduling and sequencing will be very difficult to accomplish since the network structure is really present and is rather thoroughly exploited in the algorithm considered. Author (GRA)

N71-23577# Aerospace Corp., El Segundo, Calif.
ON COMPUTATIONAL EFFICIENCY OF LINEAR FILTERING ALGORITHMS Technical Report, Sep. 1969 Aug. 1970
I. A. Gura and A. B. Bierman 15 Nov. 1970 41 p refs
(Contract F04701-70-C-0059)
(AD-718410; TR-0059(6521-01)-1; SAMSO-TR-71-22) Avail: NTIS CSCL 12/1

Although considerable attention has been given to various aspect of the filtering problem, the question of computer requirements has not been analyzed in detail. The report presents an attempt at a systematic analysis of this problem. Formulae for the arithmetic operation count and storage requirements are derived for several popular filtering algorithms within the framework of a general estimation problem. Parameters included in the study are the dimensions of the state vector, the frequency and number of observations, and the frequency of state vector updates. The results for each algorithm are discussed from a practical viewpoint and comparisons are made for certain interesting cases. Several common misconceptions are exposed. Author (GRA)

N71-23578# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
AN INTRODUCTION TO THE HYPERBOLIC DIFFUSION EQUATION
Joseph H. Shinn Nov. 1970 30 p
(AD-718616; ECOM-5341; OSD-1366) Avail: NTIS CSCL 12/1

The paper is a synopsis of the basic premises of the hyperbolic form of the diffusion equation, collected from not readily accessible references. The premises are introduced in simplified form for application by meteorologists. The Markov process in phase space and the Lagrangian-Eulerian transform are discussed. Derivations of the hyperbolic equation, one from momentum consideration and one using a Markov process, are presented. Finally, the hyperbolic and the parabolic forms are compared. The hyperbolic diffusion equation offers advantages over the classical parabolic equation in the possibility of obtaining exact solutions and in the realistic physical assumptions under which it is derived. Author (GRA)

N71-23579# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
EXACT DISTRIBUTIONS OF THE INTERMEDIATE ROOTS OF A CLASS OF RANDOM MATRICES Final Report
P. R. Krishnaiah and V. B. Waikar Dec. 1970 17 p refs
(AD-718427; ARL-70-0280) Avail: NTIS CSCL 12/1

In this paper, the authors derive expressions for the cumulative distribution functions of the individual intermediate roots of a class of random matrices. This class includes Wishart matrix, multivariate analysis of variance matrix and canonical correlation matrix. The expressions obtained are in terms of the linear combinations of products of certain double integrals. Author (GRA)

N71-23711# California Univ., Livermore. Lawrence Radiation Lab.
OPTIMUM DESIGN OF TWO-DIMENSIONAL NONRECURSIVE DIGITAL FILTERS
M. P. Ekstrom and V. R. Algazi 19 Nov. 1970 8 p refs Presented at 4th Asilomar Conf. on Circuits and Systems, Pacific Grove, Calif., 18–20 Nov. 1970 Sponsored by AEC
(UCRL-72663; CONF-701117-1) Avail: NTIS

An algorithm is presented for the design of two dimensional nonrecursive digital filters. The filter input and desired output are random fields with known covariance arrays. The design is based on minimizing a mean square error criterion subject to constraints on the orders of the filter. The numerical aspects of the design algorithm and implementation of the filter are treated extensively. Author

N71-23738# Boeing Scientific Research Labs., Seattle, Wash.
FINITE DIFFERENCE CALCULATIONS OF THE BEHAVIOR OF A DISCONTINUOUS SIGNAL NEAR A CAUSTIC
R. Seebass, E. M. Murman, and J. A. Krupp Jan. 1971 11 p refs Presented at the Conf. on Sonic Boom Res., 3d, Washington, D.C., 29–30 Oct. 1970
(AD-718835; D1-82-1040) Avail: NTIS CSCL 20/1

It is important to predict sonic boom overpressure signatures in the vicinity of a caustic. In particular, one needs to be able to calculate the overpressure when the caustic surface intersects, or when it is near the ground. While the analytical formulation of this problem is a simple one, the solution by formal mathematical techniques presents great difficulties. Consequently, there is great impetus for developing numerical techniques that can provide such predictions. Here the authors report on the extension to the caustic problem of a technique developed by Murman and Cole for transonic flows. Author (GRA)

N71-23739# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
ON THE SEPARATION THEOREM FOR LINEAR SYSTEMS, QUADRATIC CRITERIA AND CORRELATED NOISE
Dimitri P. Bertsekas Oct. 1970 27 p refs
(Grant AF-AFOSR-1724-69)
(AD-718435; AFOSR-TR-71-0165) Avail: NTIS CSCL 12/1

The paper is concerned with the extension of the well known separation theorem for linear systems and quadratic criteria to the case where the input and observation disturbance vectors are correlated. The problem is treated without the usual assumption of sequential correlation for these disturbance vectors, which allows one to use state augmentation techniques. It is shown that the optimal controller can be seperated into an estimator and an actuator. The structure of the estimator is further investigated and schemes that can be practically implemented are derived for some cases of interest. Author (GRA)

N71-23740# Tel-Aviv Univ. (Israel). Dept. of Mathematical Sciences.
NUMERICAL SOLUTION OF QUASI-CONSERVATIVE HYPERBOLIC SYSTEMS: THE CYLINDRICAL SHOCK PROBLEM
S. Abarbanel and M. Goldberg 26 Jan. 1971 54 p refs
(Contract F61052-69-C-0041)
(AD-717956; AFOSR-70-3011TR) Avail: NTIS CSCL 12/1

The paper discusses the numerical solution of hyperbolic systems of partial differential equations which are in quasi-conservation form. A basic Lax-Wendroff like scheme is developed. In order to treat problems with discontinuous solutions an iterative procedure is proposed. The stability and convergence of the various schemes are investigated. It is shown that it is possible to have time steps considerably larger than those allowed according to the C.F.L. (Courant - Friedricks - Levy) criterion. The method is then applied to the case of converging-diverging cylindrical shock waves. Detailed behavior near the axis at the time of shock coalescence is obtained, as well as the general flow field at various times. The results are compared with Payne and the differences are pointed out. Author (GRA)

N71-23743# RAND Corp., Santa Monica, Calif.
INVARIANT IMBEDDING AND THE SOLUTION OF FREDHOLM INTEGRAL EQUATIONS WITH DISPLACEMENT KERNELS
J. L. Casti Nov. 1970 166 p refs
(Contract F44620-67-C-0045; Proj. RAND)
(AD-718090; R-639-PR) Avail: NTIS CSCL 12/1

A new theory is given for solving integral equations of a type that arises in many practical problems of radiative transfer through the atmosphere and in nuclear reactors. By regarding the interval length as a basic imbedding parameter rather than as a constant, two separate initial value problems are obtained for the unknown function. If the two Cauchy systems have a unique solution, that solution satisfies the original equation; if not, there is no unique solution to the original Fredholm equation. An appended FORTRAN program turns the solution of Fredholm integral equations with displacement kernels into a routine computing task. Compared with 3 standard methods--successive approximations, linear algebraic equations, and averaging functional corrections--the new program was much faster in almost all cases tried. Moreover, it automatically provides solutions for all interval lengths less than the specified length. Finally, the report shows how to extend the concept to other types of integral equations in many important cases. Author (GRA)

N71-23744# Missouri Univ., Rolla.
INFERENTIAL PROCEDURES FOR THE WEIBULL AND GENERALIZED GAMMA DISTRIBUTIONS Final Report
Lee J. Bain and Charles E. Antle Wright-Patterson AFB, Ohio ARL Nov. 1970 125 p refs
(Contract F33615-70-C-1018)
(AD-718103; ARL-70-0266) Avail: NTIS CSCL 12/1

The report is concerned primarily with two general topics, the development of statistical procedures for the two-parameter and three-parameter Weibull distributions based on maximum likelihood estimators, and a study of the properties of the Weibull distribution as a life-testing model when the more general three-parameter generalized gamma distribution is assumed applicable. New statistical methods for the generalized gamma distribution are developed to make this study possible. The procedures developed for the Weibull distribution are also applied to the double exponential distribution. Author (GRA)

N71-23745# Bell Telephone Labs., Inc., Whippany, N.J.
PARTICLE IN CELL METHOD FOR MODEL KINETIC EQUATIONS
R. J. Mason and C. K. Chu (Columbia Univ., New York) 1970 9 p refs Presented at 7th Internl. Symp. on Rarefied Gas Dyn., Pisa, Italy
(Contract AT(30-1)-3954)
(CU-3954-3; CONF-700712-1) Avail: NTIS

A particle-in-cell scheme is proposed for the solution of model kinetic equations by computer simulation. Specific application is made to the one-dimensional Krook equation. Typical results for the nonlinear piston and Riemann problems are presented. Author

N71-23807# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
FUNCTIONAL INTEGRAL APPROACH TO DUAL THEORY
J.-L. Gervais and B. Sakita Feb. 1971 74 p refs Sponsored by Guggenheim Mem. Found. CSCL 12A
(LPTHE-71/10) Avail: NTIS

It is shown that dual-resonance amplitudes can be expressed in terms of rudimental amplitudes defined by functional integrals which correspond to transition amplitudes of quantum mechanical systems of strings with imaginary time. The equivalence between path integral and operator formulation of quantum mechanics is used to establish the connection between this approach and the usual operator approach. The factorization of rudimental amplitudes is studied to obtain the Feynman-like rules for dual-resonance amplitudes. This allows expressing N-Reggeon vertices in terms of rudimental amplitudes, and determining the propagator which is shown to be the usual spurious free twisted propagator. N-loop orientable diagrams are calculated. In general, the functional integrals considered can be calculated by solving appropriate Neumann's boundary-value problems of corresponding bounded Riemann surfaces. This provides a generalization of the analog model to the case of external Reggeons which are described by extended momentum distributions on the boundaries. Author

N71-23964*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AN EXTENSIVE ENGLISH LANGUAGE BIBLIOGRAPHY ON GRAPH THEORY AND ITS APPLICATIONS, SUPPLEMENT 1
Narsingh Deo 15 Apr. 1971 35 p refs
(Contract NAS7-100)
(NASA-CR-118044; JPL-TR-32-1413-Suppl-1) Avail: NTIS CSCL 12A

Additional listings of published reports to the earlier bibliography on graph theory (see N69-40245) are presented. Most of the supplementary entries cited appeared during the past two years. N.E.N.

N71-24041*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NUMERICAL ANALYSIS OF A PAIR OF SINGULAR INTEGRAL EQUATIONS WITH A PRINCIPAL VALUE
Raymond C. Clerkin Washington Apr. 1971 15 p ref
(NASA-TM-X-2270; E-5974) Avail: NTIS CSCL 12A

A numerical analysis of a pair of integral equations is described. One equation is of the Volterra type and has a singularity which requires special handling. The other equation is of the Fredholm type with a principal value. The technique of the integration of the principal value integral is described and tested on an improper integral with a known solution. To attain convergence of the iterative solution by the method of Picard it was necessary to take two actions to overcome instability near the singularity: (1) reduce the relaxation parameter, and (2) constrain one function to behave smoothly near the singularity. Author

N71-24089*# Pittsburgh Univ., Pa. Dept. of Electrical Engineering.
STABILITY OF THE SOLUTIONS OF ELLIPTIC PARTIAL DIFFERENTIAL EQUATIONS WITH GENERAL BOUNDARY CONDITIONS

Eugene Jacob Reiser (Ph.D. Thesis) 15 Dec. 1970 199 p refs
(Grant NGR-39-011-039)
(NASA-CR-118036) Avail: NTIS CSCL 12A

Sufficient conditions are established to ensure the existence, uniqueness, stability and symptotic stability of the solution to an initial-boundary value problem with general boundary and initial conditions. The equation with the boundary conditions and initial condition is reduced to an abstract (nonlinear) operator differential equation in which A is an (unbounded) linear operator with domain and range both contained in the same real Hilbert space H, and f is a nonlinear function mapping all of H into H. With the proper definition of the base Hilbert space H, A becomes an extension of the operator A(x,D). The investigation of stability criteria is extended to the study of another initial-boundary value problem. With certain restrictions on the system and on the nonlinear function f(u), stability criteria is established for the general boundary value problem from the results obtained for the abstract operational differential equation. Applications are given which show how the theory can be applied to a large class of physical and engineering problems. Author

N71-24186 Kansas Univ., Lawrence.
A STEEPEST-DESCENT ALGORITHM FOR MINIMIZING SENSITIVITY OF OPTIMAL SYSTEMS TO VARIATIONS IN THEIR PARAMETERS
William Francis Teague (Ph.D. Thesis) 1969 122 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 70-11078

For a given optimal control problem the parameters of the system that is to be optimized are not always accurately known. Mathematical prediction of the errors and their minimization in the terminal conditions of the optimal system is considered. Assuming the statistical characteristics of the system parameters are known, a positive measure of the sensitivity of the system is formulated, such that if this sensitivity measure is reduced, the sensitivity of the system to variations in its parameters is also reduced. The optimization problem is reformulated and it is shown that a sensitivity measure, consisting of auxiliary (sensitivity) variables and statistical variances of the system's parameters, can be incorporated into an augmented sensitivity performance index to be minimized by modifying the commonly used technique of steepest descent. Dissert. Abstr.

N71-24187 University of Southern Calif., Los Angeles.
IMPLICIT FREE BOUNDARY PROBLEMS FOR THE HEAT EQUATION
Gary Gordon Sackett (Ph.D. Thesis) 1969 64 p
Avail: Univ. Microfilms: HC $3.60/Microfilm $3.00 Order No. 70-8541

A class of free boundary problems for the heat equation denoted as implicit free boundary problems has been studied. The problems studied do not include a free boundary condition which explicitly contains the derivative of the free boundary; rather, the free boundary appears implicitly in these conditions. The method used in studying these problems is a modification of a technique in which the time variable is subjected to finite difference operations, but the position variable is left continuous. This leads to the study of a family of second order linear differential equations. The major result exhibited is an existence and uniqueness theorem for the problem. Dissert Abstr.

N71-24247# Manchester Univ. (England). Statistical Lab.
THE VIRTUAL WAITING TIME OF THE GI/G/1 QUEUE IN HEAVY TRAFFIC
E. K. Kyprianou Jan. 1971 42 p refs
(Rept-26/EKK/2) Avail: NTIS

The weak convergence of a sequence of stochastic processes induced in the function space by sequencing is used to determine the virtual waiting time of the GI/G/1 queue in heavy traffic. It is shown that the waiting times of a queueing system are in fact an imbedded Markov chain in the virtual waiting time process of the system at the points of regeneration t sub 1, t sub 2, ... where t sub n is the time of arrival of the nth customer. The results obtained for the waiting time of the GI/G/1 queue can be extended to hold for the virtual waiting time process itself. Author

N71-24248# Technische Hogeschool, Eindhoven (Netherlands).
THE INSTRUMENTAL VARIABLE METHOD AND RELATED IDENTIFICATION SCHEMES
A. J. Smets (M.S. Thesis) Nov. 1970 89 p refs
(TH-70-E-15) Avail: NTIS CSCL 12A

The instrumental variable method provides an estimator with quick convergence, if the output noise level is not excessively high and if the instrumental variables are taken from the model output sequence. The model parameters are adjusted in an intermittent way (time-varying system) according to the estimates of the process parameters. If high noise powers occur, the initial model vector has a strong effect on the speed convergence. It is shown that the method indicated by Wong to obtain the optimal I.V. matrix, can be described in a much more elegant way. This leads to the filtering of input, output and model output data with a filter having the same parameters as those of the -inverse- noise filter. The close analogy between the optimal I.V. method and the generalized least squares method becomes apparent and some extended matrix schemes are discussed. Author

N71-24249# Illinois Univ., Urbana. Dept. of Computer Science.
SEQUENCE DETERMINATION FROM FRAGMENT DATA
John C. Schwebel 16 Nov. 1970 39 p
(Contract AT(11-1)-1018)
(COO-1018-1219) Avail: NTIS

The determination or reconstruction of a completely ordered linear string (sequence) of terminals, given the results of some fragmentation of the string, is considered. The degree of order assumed in the fragmented string, i.e. the properties of the input data, are crucial both in defining the class of problems which can be solved by a given method and in relating the abstract problem to physical applications. A class of problems for the idealized case of unambiguous fragment identification is analysed and an algorithm and program are given to solve this problem. Determined is the linear ordering of the (monomer) subunits in natural polymers, which are chains of monomers configured into complex three dimensional structures. Two examples are amino acid sequencing in proteins and nucleotide sequencing in deoxyribonucleic acid (DNA) and ribonucleic acid (RNA). Author (NSA)

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N71-23142# Japan Meteorological Agency, Tokyo.
AEROLOGICAL DATA OF JAPAN, JUNE 1970
1971 325 p refs
Avail: NTIS HC $8.00/MF $0.95

Monthly upper air data observed in Japan and its vicinity by the Japan Meteorological Agency, the Japan Defence Agency and the United States Air Force are reported. The observations made by Japan are obtained according to JMA: Guide for Method of Upper Air Observation; that is, the data are corrected for temperature error due to solar radiation and the effect of low temperature on the vacuum cell, and the curvature of the surface of the earth is taken into account in the computation of upper winds. Author

N71-23143# Japan Meteorological Agency, Tokyo.
AEROLOGICAL DATA OF JAPAN, FEBRUARY 1970
1970 276 p refs
Avail: NTIS

Monthly upper air data observed in Japan and its vicinity by the Japan Meteorological Agency, the Japan Defence Agency and the United States Air Force are reported. The observations made by Japan are obtained according to JMA: Guide for Method of Upper Air Observation; that is, the data are corrected for temperature error due to solar radiation and the effect of low temperature on the vacuum cell, and the curvature of the surface of the earth is taken into account in the computation of upper winds. Author

N71-23144# Japan Meteorological Agency, Tokyo.
AEROLOGICAL DATA OF JAPAN, APRIL 1970
1971 293 p refs
Avail: NTIS

For abstract, see N71-23143.

N71-23145# Japan Meteorological Agency, Tokyo.
AEROLOGICAL DATA OF JAPAN, MAY 1970
1971 299 p refs
Avail: NTIS

For abstract, see N71-23143.

N71-23178# Joint Publications Research Service, Washington, D.C.
METEOROLOGY
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 249 31 Mar. 1971 p 6–15 (See N71-23176 12-30)
Avail: NTIS

Atmospheric measurements and investigations are briefly described. Vertical and horizontal distributions of radioisotopes from nuclear explosions in middle latitudes and over Southern Hemisphere oceans are discussed. Clear air turbulence in the stratosphere, and turbulence measurements by radar and aircraft, and aerosol propagation are reported. Clouds and precipitation, aerological measurements over sea and land, radiosonde developments, satellite-borne actinometry, and the building of a hydometeorological observatory in Brest are also reviewed. N.E.N.

N71-23215+ Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie und Geophysik.
METEOROLOGICAL DATA. VOLUME 115, NO. 12: RESULTS OF THE ASCENTS OF THE RADIOSONDE STATION, BERLIN-TEMPELHOF, OF THE INSTITUT FUER METEOROLOGIE UND GEOPHYSIK OF THE FREIE UNIVERSITAET BERLIN, JANUARY 1970. DAILY MEASUREMENTS, MONTHLY EVALUATION AND CLIMATOLOGICAL VALUES, AS WELL AS RESULTS OF SPECIAL ASCENTS [METEOROLOGISCHE ABHANDLUNGEN. BAND 115, HEFT 1: ERGEBNISSE DER AUFSTIEGE DER RADIOSONDENSTATION BERLIN-TEMPELHOF DES INSTITUTS FUER METEOROLOGIE UNDE GEOPHYSIK DER FREIEN UNIVERSITAET BERLIN IM JAHRE 1970, JANUAR. TAEGLICHE MESSRESULTATE MONATLICHE BEARBEITUNG UND KLIMATOLOGISCHE WERTE, SOWIE MESSERGEBNISSE VON SPEZIALAUFSTIEGEN]
Eugen Pantzke, Richard Scherhag et al 1970 196 p refs In GERMAN; ENGLISH summary
Avail: NTIS

The detailed results of the radiosonde ascents performed by the aerological station of the Institute for Meteorology and Geophysics at Berlin University are presented. Using these data, monthly time cross sections of the averaged temperature and the zonal and meridional wind components in heights above 30 km were constructed. Extreme and mean values of the temperature, pressure, geopotential, wind data, refractivity, pseudopotential temperature and velocity of sound were extracted for all standard pressure surfaces, several height levels, the tropopause and the freezing level. The data of the ozone ascents are given in tabular and graphical forms. Author

N71-23216+ Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie Und Geophysik.
METEOROLOGICAL DATA. VOLUME 113, NO. 2: BERLIN MEASUREMENTS. DIGITAL AND ANALOG RESULTS FROM THE CENTRAL MEASUREMENT REGISTRATION FACILITY AND FROM OTHER INSTRUMENTS FOR THE YEAR 1970 Quarterly Report [METEOROLOGISCHE ABHANDLUNGEN. BAND 113, HEFT 2: BERLINER MESSWERTE DER ZENTRALEN MESSWERTREGISTRIERANLAGE UND WEITERER INSTRUMENTE FUER DAS JAHR 1970. TEIL II, 2. VIERTELJAHR]
Richard Scherhag, Erich Wedler et al 1970 377 p In GERMAN (QR-2-Pt-2) Avail: NTIS

Data tables and charts presented contain temperature, wind velocity and direction, precipitation, radioactivity and dust measurements for the Berlin area obtained during the period April through June, 1970. Radio frequency interference registrations are also included. Transl. by G.G.

N71-23237# Royal Aircraft Establishment, Farnborough (England).
THE DETERMINATION OF THE SPECTRUM OF DROPS BY THE SMALL ANGLES METHOD [OPREDELENIE SPEKTRA KAPEL METHODOM MALYKH UGLOV]
K. S. Shifrin et al Nov. 1970 28 p refs Transl. into ENGLISH from Russian report
(RAE-Lib-Trans-1529) Avail: NTIS

A method of determining the microstructure of clouds and fogs by measuring the light scattered at small angles, and the design and accuracy of a suitable laboratory apparatus are described. A table of the function xJ sub1(x)Y sub1(x) is included. Author

N71-23238*# Michigan Univ., Ann Arbor. High Altitude Engineering Lab.
PERTURBATIONS TO OBSERVED AMBIENT NEUTRAL DENSITIES DUE TO PRESENCE OF AN ORBITING GEOPHYSICAL OBSERVATORY
B. B. Hinton and R. J. Leite Jan. 1971 22 p refs
(Grant NGR-23-005-383; ORA Proj. 03346)
(NASA-CR-117897; Rept-03346-2-T) Avail: NTIS CSCL 03B

The perturbations by a spacecraft in the density of ions and neutral particles as it moves through the upper atmosphere were studied. Estimates are given for the resultant perturbations on measured values of ambient neutral particle densities for mass spectrometer experiments mounted in an Oribtal Plane Experiment Package of an Oribitng Geophysical Observatory (OGO). Author

N71-23249+ Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie und Geophysik.
METEOROLOGICAL DATA. VOLUME 112, NO. 8: RESULTS OF THE SYNOPTIC SERVICE DURING 1970. DAILY WEATHER MAPS (GROUND, 500 mb, 300 mb) AND BRIEF SCIENTIFIC ARTICLES, AUGUST [METEOROLOGISCHE ABHANDLUNGEN. BAND 112, HEFT 8: ERGEBNISSE DES SYNOPTISCHEN DIENSTES IM JAHRE 1970. TAEGLICHE WETTERKARTEN (BODEN, 500 mb, 300 mb UND KLEINERE WISSENSCHAFTLICHE AUFSAETZE, AUGUST]
Manfred Geb, Leopold Klauser, Richard Scherhag et al 1970 150 p In GERMAN
Avail: NTIS

Daily weather maps are presented of the Northern Hemisphere for August, 1970. Synoptic measurements were made at ground level, 500 mb, and 300 mb. Climatological temperature and precipitation maps for the Berlin area and brief studies on thunderstorm activities are included. Transl. by G.G.

N71-23290+ Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie und Geophysik.
METEOROLOGICAL DATA. VOLUME 108, NO. 1: DAILY AND MONTHLY NORTHERN HEMISPHERE 30 MILLIBAR SYNOPTIC WEATHER MAPS OF THE YEAR 1969. PART 1: JANUARY–MARCH Quarterly Technical Status Report
Dietrich Just, Barbara Kriester, Karin Labitzke, Renate Lenschow, Karin Petzoldt et al 1970 104 p refs
(Contract DAJA37-70-C-2330)
(QR-1-Pt-1) Avail: NTIS

Daily and mean monthly synoptic weather maps of the Northern Hemisphere for January through March, 1969 are presented. Depicted is the stratospheric circulation during the first quarter. Transl. by G.G.

N71-23350*# Techtran Corp., Glen Burnie, Md.
THE MARES' TAILS OF THE ANCIENT MARINERS AND THE TROPOSPHERIC JET STREAMS [LE PIED DE VENT DES ANCIENS MARIN A VOILE ET LES COURANTS-JETS TROPOSPHERIQUES]
P. Schereschewsky Washington NASA Apr. 1971 6 p Transl. into ENGLISH from Compt. Rend. (Paris), 1971 p 1–4
(Contract NASw-2037)
(NASA-TT-F-13606) Avail: NTIS CSCL 04B

The relationship of the cirrus-cloud formation known as mares tails and jet streams in the troposphere is examined in the light of possible application for aerial navigation. Author

N71-23391# Aerometric Research, Inc., Goleta, Calif.
LARGE SCALE EFFECTS OF CLOUD SEEDING: 1967–70 SEASON AND TWO YEAR SUMMARY Final Report
Keith J. Brown and Robert D. Elliott Oct. 1970 52 p refs
(Contract DI-14-06-D6841)
(AD-718814; ARI-70-20) Avail: NTIS CSCL 4/2

This report covers the results of two years of field testing to determine the existence, magnitude and causes of large scale effects of cloud seeding. The field program was located north and east of an ongoing research seeding project by North American Weather Consultants under contract to the Naval Weapons Center. Substantial evidence is presented showing that precipitation has been more than doubled over a large area about 70 miles downwind from a point seeding source in Santa Barbara County, California. The causes of these increases have not yet been determined, but preliminary results indicate they are related to air mass temperature and wind speed and direction. GRA

N71-23437# Weather Wing (4th), Ent AFB, Colo.
PREDICTING HEAVY SNOWFALL FOR COLORADO SPRINGS BASED ON COMPUTER DERIVED SYNOPTIC MAP TYPES
Franklin R. Hartranft, Joe S. Restivo, and Robert C. Sabin Dec. 1970 185 p
(AD-718422; WW-TP-70-5) Avail: NTIS CSCL 4/2

The paper contains the results of applying the weather map typing procedures described in 4 WWg Technical Paper 70-2, Computerized Map Typing Procedures and Their Application in the Development of Forecast Aids, to the specific problem of heavy snow forecasting in Colorado Springs, Colorado. The case study technique described in SECTION IIIA of 4WWTP 70-2 was employed to derive sets of surface and 700 mb map types which are necessary conditions for the occurrence of heavy snow. The objective forecast study technique described in Section IIIB of 4WWTP 70-2 was used to develop a set of forecast aids (scatter diagrams) for each surface/700 mb map type. The snow study described in this paper demonstrates a new approach to objective forecast study development. The synoptic situation has been objectively integrated into the initial stratification of climatological data and therefore permits an objective consideration of surface and 700 mb map patterns as the initial step in the forecast procedure. The inclusion of climatologically-derived map types in the forecast study also allows an excellent means of incorporating prognostic chart information. Author (GRA)

N71-23517*# National Aeronautics and Space Administration, Washington, D.C.
BARIUM CLOUD LAUNCH
14 Apr. 1971 14 p
(NASA-News-Release-71-61) Avail: NASA Scientific and Technical Information Facility, P. O. Box 33, College Park, Md. 20740 CSCL 04B

An experiment aimed at ejecting into space a chemical which will produce a glowing, barium ion cloud about 20,000 miles above the Earth is discussed. If successfully launched the cloud will be visible to the naked eye for 15 to 20 minutes after release of the barium as a first magnitude or bright star over most of the Western Hemisphere the night of April 20. Author

N71-23680+ Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie und Geophysik.
METEOROLOGICAL DATA. VOLUME 112, NO. 9: RESULTS OF THE SYNOPTIC SERVICE DURING 1970. DAILY WEATHER MAPS (GROUND, 500 mb, 300 mb) AND BRIEF SCIENTIFIC ARTICLES, SEPTEMBER [ERGEBNISSE DES SYNOPTISCHEN DIENSTES IM JAHRE 1970. TAEGLICHE WETTERKARTEN (BODEN, 500 mb, 300 mb) UND KLEINERE WISSENSCHAFTLICHE AUFSAETZE, SEPTEMBER]
Manfred Geb, Leopold Klauser, Richard Scherhag et al 1970 157 p refs In GERMAN
Avail: NTIS

Daily weather maps are presented of the Northern Hemisphere for September, 1970. Synoptic measurements were made at ground level, 500 mb, and 300 mb. Climatological temperature and precipitation maps for the Berlin area are included and a forecasting model for tropospheric vertical motion is described. Transl. by G.G.

N71-23681+ Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie und Geophysik.
METEOROLOGICAL DATA. VOLUME 104, NO. 12: RESULTS OF THE ASCENTS OF THE RADIOSONDE STATION, BERLIN-TEMPELHOF, OF THE INSTITUT FUER METEOROLOGIE UND GEOPHYSIK OF THE FREIE UNIVERSITAET BERLIN, DECEMBER 1969. DAILY MEASUREMENTS, MONTHLY COMPILATION AND CLIMATOLOGICAL VALUES, AS WELL AS RESULTS OF SPECIAL ASCENTS [METEOROLOGISCHE ABHANDLUNGEN, BAND 104, HEFT 12: ERGEBNISSE DER AUFSTIEGE DER RADIOSONDENSTATION, BERLIN-TEMPELHOF, DES INSTITUTS FUER METEOROLOGIE UND GEOPHYSIK DER FREIEN UNIVERSITAET BERLIN IM JAHRE 1969, DEZEMBER. TAEGLICHE MESSREBULTATE, MONATLICHE BEARBEITUNG UND KLIMATOLOGISCHE WERTE, SOWIE MESSERGEBNISSE VON SPEZIALAUFSTIEGEN]
Eugen Pantzke, Richard Scherhag et al 1970 191 p refs In GERMAN; ENGLISH summary
Avail: NTIS

The detailed results of the radiosonde ascents performed by the aerological station of the Institut fur Meteorologie und

Geophysik der Freien Universitat Berlin are presented. Using these data monthly time cross sections of the averaged temperature and the zonal and meridional wind components in heights above 30 km were constructed. Extreme and mean values of the temperature, pressure, geopotential, wind data, refractivity, pseudopotential temperature and velocity of sound, were extracted for all standard pressure surfaces, several height levels, the tropopause and the freezing level. The data of the ozone-ascents were given in tabular and graphical form. Author

N71-23682+ Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie und Geophysik.

METEOROLOGICAL DATA. VOLUME 115, NO. 2: RESULTS OF THE ASCENTS OF THE RADIOSONDE STATION, BERLIN-TEMPELHOF, OF THE INSTITUT FUER METEOROLOGIE UND GEOPHYSIK OF THE FREIE UNIVERSITAET BERLIN, FEBRUARY 1970. DAILY MEASUREMENTS, MONTHLY COMPILATION AND CLIMATOLOGICAL VALUES, AS WELL AS RESULTS OF SPECIAL ASCENTS [METEOROLOGISCHE ABHANDLUNGEN. BAND 115, HEFT 2: ERGEBNISSE DER AUFSTIEGE DER RADIOSONDENSTATION, BERLIN-TEMPELHOF, DES INSTITUTS FUER METEOROLOGIE UND GEOPHYSIK DER FREIEN UNIVERSITAET BERLIN IM JAHRE 1970, FEBRUAR. TAEGLICHE MESSRESULTATE, MONATLICHE GEARBEITUNG UND KLIMATOLOGISCHE WERTE, SOWIE MESSERGEBNISSE VON SPEZIALAUFSTIEGEN]

Eugene Pantzke, Richard Scherhag et al 1970 186 p refs In GERMAN; ENGLISH summary

Avail: NTIS

For abstract, see N71-23681.

N71-23683+ Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie und Geophysik.

METEOROLOGICAL DATA. VOLUME 115, NO. 3: RESULTS OF THE ASCENTS OF THE RADIOSONDE STATION, BERLIN-TEMPLEHOF, OF THE INSTITUT FUER METEOROLOGIE UND GEOPHYSIK OF THE FREIE UNIVERSITAET BERLIN, MARCH 1970. DAILY MEASUREMENTS, MONTHLY COMPILATION AND CLIMATOLOGICAL VALUES, AS WELL AS RESULTS OF SPECIAL ASCENTS [METEOROLOGISCHE ABHANDLUNGEN. BAND 115, HEFT 3: ERGEBNISSE DER AUFSTIEGE DER RADIOSONDENSTATION, BERLIN-TEMPELHOF, DES INSTITUTS FUER METEOROLOGIE UND GEOPHYSIK DER FREIEN UNIVERSITAET BERLIN IM JAHRE 1970, MAERZ. TAEGLICHE MESSRESULTATE, MONATLICHE BEARBEITUNG UND KLIMATOLOGISCHE WERTE, SOWIE MESSERGEBNISSE VON SPEZIALAUFSTIEGEN]

Eugen Pantzke, Richard Scherhag et al 1970 182 p refs In GERMAN; ENGLISH summary

Avail: NTIS

For abstract see N71-23681.

N71-23684+ Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie und Geophysik.

METEOROLOGICAL DATA. VOLUME 115, NO. 4: RESULTS OF THE ASCENTS OF THE RADIOSONDE STATION, BERLIN-TEMPELHOF, OF THE INSTITUT FUER METEOROLOGIE UND GEOPHYSIK OF THE FREIE UNIVERSITAET BERLIN, APRIL 1970 DAILY MEASUREMENTS, MONTHLY COMPILATION AND CLIMATOLOGICAL VALUES, AS WELL AS RESULTS OF SPECIAL ASCENTS [METEOROLOGISCHE ABHANDLUNGEN, BAND 115, HEFT 4: ERGEBNISSE DER AUFSTIEGE DER RADIOSONDENSTATION, BERLIN-TEMPELHOF, DES INSTITUTS FUER METEOROLOGIE UND GEOPHYSIK DER FREIEN UNIVERSITAET BERLIN IM JAHRE 1970, APRIL. TAEGLICHE MESSRESULTATE, MONATLICHE BEARBEITUNG UND KLIMATOLOGISCHE WERTE, SOWIE MESSERGEBNISSE VON SPEZIALAUFSTIEGEN]

Eugen Pantzke, Richard Scherhag et al 1970 184 p refs In GERMAN; ENGLISH summary

Avail: NTIS

For abstract, see N71-23681.

N71-23830# Army Natick Labs., Mass. Earth Sciences Lab.

ANALOGS OF CANAL ZONE TEMPERATURES IN SOUTHEAST ASIA: AN ATLAS OF TEMPERATURE FREQUENCIES

Howard L. Ohman Jan. 1970 76 p refs

(AD-718611; ES-54; TR-70-33-ES) Avail: NTIS CSCL 4/2

The twenty-six maps contained in this Atlas depict the distribution of temperature in mainland Southeast Asia (Thailand, Vietnam, Cambodia, Laos, Burma south of 25 degrees N latitude, and the peninsular portion of Malaysia) during the warmest (April) and coldest (January) month of the year at levels of probability selected for their significance to research and development and to military planning. Temperature analyses for January and April have been prepared for the 5, 10, 90, and 95 percent frequency of temperature occurrence levels, also mean monthly temperature and absolute maximum temperature. Also shown on the maps are the areas of Southeast Asia subject to temperature conditions considered analogous to those experienced at two sites in the Canal Zone: Cristobal, representing the warm and wet Caribbean slopes, and Howard AFB representing the drier and hotter Pacific slopes. The principal areas of Canal Zone temperature analogy in Southeast Asia during both January and April are confined to the southernmost or equatorial portions of the region. In January, practically all of the mainland (north of about 10 degrees north latitude) is too cool to be analogous to temperature conditions of the Canal Zone. Author (GRA)

N71-23831# Weather Squadron (24th), Detachment 20, Laughlin AFB, Tex.

TERMINAL FORECAST REFERENCE FILE, LAUGHLIN AFB, TEX. Final Report

25 Jan. 1971 82 p

(AD-718119) Avail: NTIS CSCL 4/2

The reference file discusses factors affecting the weather at Laughlin AFB, Tex. Included are location and topography, weather controls, climatic aids, special synoptic studies, and case studies. Author (GRA)

N71-23832# Naval Weather Service Command, Washington, D.C.

SUMMARY OF SYNOPTIC METEOROLOGICAL OBSERVATIONS: NORTH AMERICAN COASTAL MARINE AREAS. VOLUME 14: AREA 11, BRISTOL BAY, AREA 12, ST. PAUL, AREA 13, ST. PAUL 180 W

Dec. 1970 483 p .

(AD-718345) Avail: NTIS HC $6.00/MF $0.95 CSCL 4/2

The data contained in these tables were obtained from tape data Family 11 (TDF-11), Marine Surface observations. TDF-11 was primarily funded by the Naval Weather Service Command and selected by NWSED Asheville as the most comprehensive collection of marine surface observations from which to develop a series of coastal marine summaries. The areas discussed include Bristol Bay, St. Paul Island, Alaska. Author (GRA)

N71-23833# Naval Weather Service Command, Washington, D.C.

SUMMARY OF SYNOPTIC METEOROLOGICAL OBSERVATIONS: NORTH AMERICAN COASTAL MARINE

AREAS. VOLUME 15: AREA 14, NUNIVAK, AREA 15, ST. MATTHEW, AREA 16, ST. LAWRENCE, AREA 17, CAPE LISBURNE, AREA 18, BARROW
Dec. 1970 498 p
(AD-718346) Avail: NTIS HC$6.00/MF$0.95 CSCL 4/2

The data contained in these tables were obtained from tape data Family 11 (TDF-11), Marine Surface observations. TDF-11 was primarily funded by the Naval Weather Service Command and selected by NWSED Asheville as the most comprehensive collection of marine surface observations from which to develop a series of coastal marine summaries. The areas discussed include Nunivak, St. Matthew, St. Lawrence, Cape Lisburne, and Barrow, Alaska. Author (GRA)

N71-23837# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NUMERICAL WEATHER FORECASTS
A. S. Dubov et al 30 Nov. 1970 11 p refs Transl. into ENGLISH from Glavnaya Geofizicheskaya Observ. (Leningrad), no. 218, 1967 p 19–28
(AD-718481; FTD-HT-23-700-70) Avail: NTIS CSCL 4/2

The article traces the history of numerical weather forecasting, calling upon the works of Kibel, Blinova, Yudin, Buleyev, Kagan, Shvets, Meleshko, Shneyerov, and Rukhovets. Past and present studies in this field at the GGO (Main Geophysical Observatory) are discussed. Author (GRA)

N71-23838# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HYDRODYNAMIC THEORY OF GENERAL ATMOSPHERE CIRCULATION AND NUMERICAL EXPERIMENTS
S. A. Mashkovich 24 Nov. 1970 19 p refs Transl. into ENGLISH from Meteorologicheskie Issledovaniya (USSR), no. 16, 1968 p 7–14
(AD-718623; FTD-HT-23-565-70) Avail: NTIS CSCL 4/2

A survey is made of studies on hydrodynamic theory of climate and the general circulation of the atmosphere. The most significant simplifications and limitations introduced into the solution of this problem are discussed. Emphasis is given to the important role of the numerical experiments as a method of studying the macro-atmospheric processes. A series of questions that require further investigation is formulated. Author (GRA)

N71-23839 International Geophysical Year World Data Center A, Asheville, N.C.
HIGH ALTITUDE METEOROLOGICAL DATA, VOLUME 6, NO. 9, SEPTEMBER 1969 Data Report
1971 224 p
Avail: SOD $3.00

Wind and temperature measurements from all available meteorological sounding rocket firings are presented, along with computed values for pressure, density, and speed of sound. Local radiosonde observations nearest the time of firing are included. Author

N71-23840# Finnish Meteorological Office, Helsinki.
ATMOSPHERIC PRESSURE IN FINLAND IN THE PERIOD 1931 – 1960 [ILMANPAINE KAUTENA 1931 – 1960 SOUMESSA]
Osmo Kolkki and Veikko A. Helminen 1970 44 p In ENGLISH and FINNISH
(Rept-21) Avail: NTIS

Atmosphere pressure summaries are presented which are based on observations made daily at 0700, 1500 and 2100 hours in the years 1931 to 1946 and at 0800, 1400 and 2000 hours in the years 1947 to 1960. The times are Finnish standard time = GMT + 2 hours. Fuess station barometers were used throughout as measuring instruments. A temperature and gravity correction was made in the barometer readings in connection with the observations. Reduction of atmospheric pressure to sea level was performed by means of a simplified formula in which the vertical change in air temperature and humidity in the layer of air between sea level and the barometer was disregarded. The monthly averages calculated from the three fixed-time observations mentioned are entered for each individual month on maps which are analysed. The monthly averages of atmospheric pressure are given only for the stations at which the observation series of the climatological normal period 1931 to 1960 was complete. The tables also show the 10-year averages and the monthly and annual averages for the normal period as a whole. The maps for average atmospheric pressure in 1931 to 1960 were compiled by making use of some atmospheric pressure values of weather observation stations on the Norwegian, Swedish and Soviet side. Author

N71-23841 Oklahoma Univ., Norman.
NUMERICAL VARIATIONAL OBJECTIVE ANALYSIS OF THE PLANETARY BOUNDARY LAYER IN CONJUNCTION WITH SQUALL LINE FORMATION
John Maurice Lewis (Ph.D. Thesis) 1970 72 p
Avail: Univ. Microfilms: HC $4.00/Microfilm $3.00 Order No. 70-9997

Initial values of wind, temperature, pressure, and moisture were objectively determined for use in a boundary layer forecast model. The objective analysis was accomplished by using a numerical variational method, which technique incorporates the governing thermohydrodynamical equations, as well as observations, into the initialization process. The solution to four coupled elliptic differential equations with associated boundary conditions completely determined the initial map. The analysis and prediction was applied to severe weather occurrence in the Midwest on June 10, 1968. Data from the radiosonde network and the NMC analysis were used in conjunction with the governing equations to generate the initial fields. The 3 and 6 hr forecasts of a severe storm index are discussed. The spatial distribution of the index, the product of vertical velocity, and specific humidity, is compared with the surface observation of severe weather. Dissert. Abstr.

N71-23851# National Bureau of Standards, Washington, D.C. Building Research Div.
HURRICANE CAMILLE, AUGUST 1969
R. D. Dikkers, R. D. Marshall, and H. C. S. Thom (Environ. Data Serv.) Mar. 1971 73 p refs
(NBS-TN-569) Avail: SOD $0.70

A photographic survey of the damage done by Hurricane Camille to the Mississippi-Louisiana Gulf Coast is presented. Data are included on wind speeds and storm surge. Based on these data, suggestions are made pertaining to the improvement of building design and construction practices. Author

N71-23852# Finnish Meteorological Office, Helsinki.
ON THE GUSTINESS OF THE SURFACE WIND AT HELSINKI, KUOPIO, AND VAASA AERODROMES IN 1965
Jorma Riissanen 1970 19 p refs *Its* Finn. Meteorol. Inst. Contrib. No. 75
Avail: NTIS

Recorded 10 minute mean wind velocities and corresponding maximum winds for Helsinki, Kuopio and Vaasa aerodromes were collected for the year 1965. Some statistical parameters were compiled from these observations. As a result of these computations it was found that the relation between mean gust velocity and 10 minute mean wind speed is dependent on the mean wind speed (see also Huovila (1)) and has a minimum of 1.5 to 1.3 over the range of mean speeds 0 to 30 kt. Standard deviation of maximum speeds increases from 1 to 4 kts, when mean wind speed increases from zero to 25 to 30 kts. Author

N71-23863# Analysis and Computer Systems, Inc., Burlington, Mass.
MATHEMATICAL ANALYSIS AND COMPUTER ORIENTED

ENVIRONMENTAL STUDIES Final Report, Sep. 1969 – Aug. 1970
Donald J. Armstrong, John A. Carbone, Edward D. Conway, Peter W. Lindstrom, and Carolyn M. Mandell Sep. 1970 142 p refs
(Contract F19628-70-C-0029)
(AD-718115; AFCRL-70-0581) Avail: NTIS CSCL 4/1

Contents: Rainfall, soil moisture and trafficability in the vicinity of Saigon; Correlations between areal precipitation and geopotential height; Studies of clouds and weather over sea; Wind analysis - upper air; Windy acres; Microwave acoustics; The digital sounder a basis for real time recording of ionosphere parameters; Analysis of radio propagation conditions of the ionosphere; Investigation of variations of stratospheric aerosol through photographic measurements; Wave propogation in hot magnetaplasmas; Some mathematical properties of an integral equation for three-body scattering. GRA

N71-23854 League of Women Voters, Washington, D.C.
A CONGREGATION OF VAPORS
Sep. 1970 4 p
Copyright. Avail: League of Women Voters, 1730 M Street, N.W., Washington, D.C. 20036: $0.35

Natural and man made causes of air pollution are discussed. Health problems and fatalities caused by such pollution along with ways in which the government and man can clean up his environment are included. E.H.W.

N71-23857# Danish Meteorological Inst. Charlottenlund.
METEOROLOGICAL YEARBOOK. PART 2: GREENLAND, 1958 [METEOROLOGISK ARBOG. 2 den DEL: GROENLAND]
1970 46 p In DANISH and FRENCH
Avail: NTIS

Tabulated data covering the period 1 January to 31 December 1958 are presented for Greenland. Three daily measurements from five secondary stations, and annual and monthly summaries of all meteorological parameters observed by 13 secondary and minor stations contain temperature, pressure, humidity and precipitation, wind direction and velocity, visibility and cloud cover, and snow cover measurements. Transl. by G.G.

N71-23858# Weather Wing (5th), Langley, AFB, Va. Aerospace Sciences D.
SYSTEMATIC ERRORS OF NUMERICAL PROGS
L. A. Hughes 1 Mar. 1971 9 p
(AD-718111; Rept- 5WWTN-71-1) Avail: NTIS CSCL 4/2

The paper briefly summarizes weakness of the barotropic and PE baroclinic progs currently in use by NMC. Author (GRA)

N71-23943# Naval Weather Service, Washington, D.C.
SUMMARY OF SYNOPTIC METEOROLOGICAL OBSERVATIONS. NORTH AMERICAN COASTAL MARINE AREAS. VOLUME 13: AREA 7, UNIMAK; AREA 8, DUTCH HARBOR; AREA 9, ADAK; AREA 10, ATTU
Dec. 1970 640 p refs
(AD-717949) Avail: NTIS CSCL 4/2

The data contained in these tables were obtained from tape data Family 11 (TDF-11), Marine Surface observations. TDF-11 was primarily funded by the Naval Weather Service Command and selected by NWSED Asheville as the most comprehensive collection of marine surface observations from which to develop a series of coastal marine summaries. The report discusses various areas in the Aleutian Islands. GRA

N71-23944# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HYDRODYNAMIC NUMERICAL SHORT RANGE WEATHER FORECASTING
I. A. Kibel 7 Dec. 1970 32 p Transl. into ENGLISH from the book "Meteorol. i Gidrolog. za 50 Let Sov. Vlasti, Sb. Statei" Leningrad, Gidrometeorologicheskoye Izd-Vo, 1967 p 67 – 84
(AD-718282; FTD-HT-23-702-70) Avail: NTIS CSCL 4/2

Early models for weather forecasting are reviewed, including adiabatic, barotropic, and baroclinic (quasi-geostrophic). Precipitation prediction and nonadiabatic effects are discussed, and full equations for prediction are provided. Soviet scientists have established a new problem in hydrodynamic short-range weather forecasting, more difficult than any that has preceded it, having to do with local prediction. Heretofore, comparisons have been made with synoptic methods, but the science has reached such a state now where only hydrodynamics may yield a proper solution. There are actually no synoptic methods for forecasting the spottiness of precipitation over cities or any other locality, no methods for local forecasting in mountains. One can hardly restrict himself to quasi-statistical models, to say nothing of quasi-geostrophic models. It is first necessary to have full hydrodynamic equations, with consideration of vertical accelerations. For adequate short-range work, characteristic distances will be 1 or 2 km rather than the 1000 km of previous forecasting. Author (GRA)

N71-23945# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STATISTICAL ANALYSIS OF ATMOSPHERIC PROCESSES
M. I. Yudina 27 Nov. 1970 168 p refs Transl. into ENGLISH from Gl. Geofiz. Observ., Tr. (Leningrad), no. 201, 1968 p 1 – 116
(AD-718281; FTD-MT-24-149-70) Avail: NTIS CSCL 4/2

An account is given of questions of the statistical analysis of meteorological fields of planetary scale with the help of the method of decomposition with respect to natural functions. Statistical methods are discussed to forecast ten-day and monthly air temperatures by using as predictors heat inflows and extra-atmospheric carriers of information (snow cover, iciness, and others). Author (GRA)

N71-23962 National Lending Library for Science and Technology, Boston Spa (England).
THE THERMAL ANOMALY OF JULY 1968
C. Ticu et al 16 Feb. 1971 6 p Transl. into ENGLISH from Hidrotechnica (Bucharest), no. 14, 1969, p 587 – 589
(NLL-M-20007-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The synoptic reasons for the generation of the sudden marked cooling off which occurred in one of the warmest months of the year in Rumania is analyzed. The cooling off mainly affected the western part of the country where the maximum temperatures fell in some localities by 10 to 15 C compared with those in the preceding days. Comparing the maximum temperatures for the period 18 to 24 July with earlier temperatures, one can see differences of 18 C in Banat, 14 C in Moldova, 10 to 12 C in Oltenia and Transilvania and only 8 C in Mutenia and Dobrogea. The heavy precipitation which accompanied the cooling off was mostly in the form of sudden downfalls in most parts of the country. The amount of water registered in some regions exceeded the monthly mean. Analysing the distribution of the pressure field at the time of the cooling off and for the days preceding it, on the evidence of surface and height maps as well as data recorded at meteorological stations, it was seen that in the period 18 to 24 July, the polar air which caused the cooling off penetrated the country in two stages, the first on 18 to 19 July and the second on 22 to 23 July. Author

N71-23969 National Lending Library for Science and Technology, Boston Spa (England).
HOW TO SQUEEZE OUT A CLOUD
16 Feb. 1971 4 p Transl. into ENGLISH from Pravda (Moscow), 28 Jun. 1970
(NLL-M-20300-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A news journal discussion on cloud seeding is presented. The main emphasis of the reported research is to turn clouds into rain over forest fires. Creating rainfall before clouds build up enough to cause heavy rainfall is also mentioned. N.E.N.

N71-24002 National Lending Library for Science and Technology, Boston Spa (England).
THE STATISTICAL EXPRESSION OF DIURNAL TEMPERATURE VARIATION
Sadao Tomioka 16 Feb. 1971 5 p refs Transl. into ENGLISH from Kishocho Kenkyu Jiho (Tokyo), v. 21, 1969 p 228–229
(NLL-M-20311-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Meteorological data for Kofu for the four years of 1956, 1957, 1958 and 1964 was classified into four weather types: clear, fair, cloudy and rainy, and 100 days for each type was selected. From the temperatures of those days, which was recorded on charts of daily themographs, values at every 15 minutes were read for 1956 to 1958, and at every 10 minutes for 1964, in order to compile class frequency and cumulative frequency distribution tables. Using this data, histograms were constructed and their approximate modes were examined. The class boundaries were 1 to approximately 2 deg C, and the number of classes was about 10. Author

N71-24003 National Lending Library for Science and Technology, Boston Spa (England).
EMPLOYMENT OF HARMONIC ANALYSIS IN DETERMINATION OF THE NATURAL BOUNDARIES OF THE ANNUAL SEASONS
Nadezda Sinik 11 Dec. 1970 22 p Transl. into ENGLISH from the publ. 'Zborn. Rad. Pov. Pros. 20 God. Rada Raz. Hidromet. Sluz. Jugoslav., 1947-1967' Belgrade, Savez. Hidromet., 1967 p 44–61
(NLL-M-20096-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Average annual runs of several meteorological elements for Osijek in the time period 1931 to 1960 are decomposed into harmonic spectra with the purpose of discovering the possible hidden periodicities. A consideration of every element separately shows that in the temperature regime of Osijek the spring and autumn last about two months and they are represented by the fifth harmonic component; further, in the annual runs of the precipitation amount one can find three months oscillations which are connected with the similar oscillations of the frequencies of the cold front passage over our northern territories etc. A complex insight into the climatic characteristics is given by means of the co-spectra of the harmonic components of various elements. It was shown that a simultaneous complex influence of the meteorological elements is more expressed for the longer time periods in the annual run than for the shorter rhythms. Author

N71-24004# National Meteoroligical Center, Washington, D.C.
RECENT RESEARCH IN NUMERICAL METHODS AT THE NATIONAL METEOROLOGICAL CENTER
Ronald D. McPherson Apr. 1971 40 p refs Presented at Intern. Conf. on Meteorology, Tel Aviv, Israel, 30 Nov. – 4 Dec. 1970
(NOAA-TM-NWS-BMC-50) Avail: NTIS

Numerical techniques for integrating quasi-static systems of equations are discussed. Also discussed are the concepts of numerical stability and computational economy. The results of numerical integrations of a barotropic model using these concepts are given. Alternative ways of extending the system to multilevel baroclinic models are indicated. E.H.W.

N71-24018 National Lending Library for Science and Technology, Boston Spa (England).
STAGES OF THE ATMOSPHERIC CIRCULATION EPOCHS AND THEIR ROLE IN THE FORMATION OF SOME BACKGROUND CHARACTERISTICS OF THE ATMOSPHERE AND HYDROSPHERE
A. A. Girs 24 Jan. 1971 6 p refs Transl. into ENGLISH from Arkt. Antarkt. Nauchn.-Issled. Inst., Probl. Arkt. Antarkt. (Leningrad), no. 34, 1970 p 106–108
(NLL-M-20298-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

An atmospheric model of circulation epochs including the transformation of one epoch into another and epoch stages (1 to 6 years) is described. A prediction of a long-term westerly circulation and criticism of the model are discussed. It is felt that recently calculated values of oceanographic topology can be utilized in making more accurate predictions about forthcoming epochs. N.E.N.

N71-24036 National Lending Library for Science and Technology, Boston Spa (England).
PRECIPITATION DISTRIBUTION IN GENTLY UNDULATING COUNTRYSIDE TAKING ACCOUNT OF SOME OROGRAPHIC EFFECTS
D. Hoppmann 11 Dec. 1970 9 p ref Transl. into ENGLISH from Meteorol. Abh. 92, Inst. Meteorol. Geophys., Freie Univ. Berlin (West Germany), Heft 12, Beil. 171, 1969 p 5 Presented at Meteorol. and Geophys. Seminar, Berlin, 11 Jun. 1968
(NLL-M-20094-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Precipitation models are used to investigate rainfall distribution in the Uppsala country side and plain area. The effects of orographic conditions on the distribution is discussed. Results show differences of height of about 30 m can cause rainfall differences. E.H.W.

N71-24037 National Lending Library for Science and Technology, Boston Spa (England).
STUDY OF THE STATISTICAL DISTRIBUTION OF RADAR PARAMETERS IN DIFFERENT CLOUD SYSTEMS WITH LIQUID PRECIPITATION
G. B. Brylev et al 11 Dec. 1970 4 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 243, 1969 p 8–11
(NLL-M-20091-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Statistical distributions of radar parameters in different cloud systems are investigated. Radar parameters include mean reflectivities at different levels, coefficient of coverage of an area by echoes at different levels, and mean value of maximum echo height. Results indicate statistical models of the radar parameters mean reflectivities and echoes may be useful in climatological assessment of propagation conditions for centimeter waves of the atmosphere. E.H.W.

N71-24038 National Lending Library for Science and Technology, Boston Spa (England).
AN OBJECTIVE METHOD FOR FORECASTING THUNDERSTORMS OVER THE AIRPORT SYSTEM OF MILAN FOR THE MONTHS MAY TO AUGUST
N. Minafra et al 11 Dec. 1970 14 p refs Transl. into ENGLISH from Riv. Meteorol. Aeronaut. (Italy), v. 30, no. 3, 1970 p 5–15
(NLL-M-20080-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

An objective method of forecasting thunderstorms over the airport system of Milan is given. The method makes use of: (a) the Whiting instability index as computed from the radiosoundings at Milan-Linate; (b) the wind direction at the 500 mb level given by the same soundings; and (c) the type of wind circulation at the 500 mb level. The method was checked by a statistical analysis of the thunderstorms recorded at the meteorological stations in the Milan area in each May to August period of the decade 1959 to 1968. Author

N71-24039*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.
HIGH ALTITUDE METEOROLOGICAL ROCKET WIND MEASURING SYSTEMS AND RESULTS TAKEN AT CAPE KENNEDY, FLORIDA
R. E. Turner, D. L. Johnson, and L. P. Gilchrist 30 Mar. 1971 66 p refs
(NASA-TM-X-64578) Avail: NTIS CSCL 04B

Mesospheric wind data between 65 to 85 kilometer altitudes at Cape Kennedy, Florida, as determined from the Cajun Dart, Super Loki Dart, and Hopi Dart rocket systems from February 1964 through April 1970 are presented. The three vehicle systems are individually described in detail. These rocket systems deliver wind-sensitive aluminized mylar chaff, which is ejected above 90 kilometers. Wind flow data are obtained by radar tracking of the chaff, which is free to drift with the wind as it falls. Wind data measurements made once daily from March 19 to April 21, 1970, were analyzed and an error analysis of the measuring system made. The data reduction methods are also described. Author

N71-24057# France. Direction de la Meteorologie Nationale, Paris.
DEVELOPMENT OF THE PARISIAN CLIMATE OVER 100 YEARS. EFFECTS OF URBANIZATION [EVOLUTION SECULAIRE DU CLIMAT DE PARIS. INFLUENCE D L'URBANISATION]
J. Dettwiller 1970 81 p refs In FRENCH
(Rept-52) Avail: NTIS

The concentration of many millions of inhabitants in a superficially restrained area produces climatological modifications, mainly through substitution of the vegetation cover by asphalt and cement surfaces. Constructions and hard covers affect the local energy balance profoundly and industrial production activities modify significantly the quantity and quality of the received solar energy as well as the diurnal radiation characteristics. Statistical analyses of climatological parameter modifications as measured during the last 100 to 150 years for the Parisian urban valley establish the progressive increase in minimum and maximum temperature levels, the overall reduction of icy days and the spectacular low diurnal thermal amplitude. Other climatological alterations are probably connected with the progressive reduction of radiation caused by increased atmospheric pollution. Transl. by G.G.

N71-24104+ Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie und Geophysik.
METEOROLOGICAL DATA. VOLUME 116; NO. 3: DAILY ALTITUDE MAPS OF THE 100 mb LEVEL AND THE 50 mb LEVEL AS WELL AS MONTHLY MEAN MAPS FOR 1970 Quarterly Report [METEOROLOGISCHE ABHANDLUNGEN. BAND 116, HEFT 3: TAEGLICHE HOEHENKARTEN DER 100-mb-FLAECHE UND DER 50-mb-FLAECHE SOWIE MONTALICHE MITTELKARTEN FUER DASJAHR 1970. TEIL III, 3. VIERTELJAHR]
Barbara Kriester, Karin Labitzke, Renate Lenschow, Wolfgang Roeder, Richard Scherhag et al 1970 224 p refs
(QR-3-Pt-3) Avail: NTIS

A series of stratospheric weather maps is presented which contain daily height and temperature analysis of constant pressure levels for three months for the whole the Northern Hemisphere, based on rawinsonde and upper stratosphere rocketsonde data performed with the aid of a hydrostatic build-up method. The corresponding monthly mean maps, their variations and deviations are included as well as the mean gridpoint data, calculated from daily values. The stratospheric circulation of polar, middle, and tropical latitudes is described for 1970. Author

N71-24105# Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie und Geophysik.
METEOROLOGICAL DATA. VOLUME 111, NO. 4: PREPARATORY STUDIES FOR THE PROGNOSIS OF CONVECTIVE CLOUD COVERS BY COMPUTERS [METEOROLOGISCHE ABHANDLUNGEN. BAND 111, HEFT 4: VORBEREITENDE UNTERSUCHUNGEN ZUR PROGNOSE KONVEKTIVER BEWOELKUNG MIT DATENVERARBEITUNGSMASCHINEN]
Juergen Pelz 1970 71 p refs In GERMAN
Avail: NTIS

An objective method is described for the prognosis of convective clouds, especially for the forecasting of showers and thunderstorms. Days with fronts or frontal phenomena were excluded. Since the study is based on the data of only one radiosonde station the horizontal variations of the meteorological fields are neglected. Some necessary parameters are provided for calculating the ceiling and the upper limit of the convective clouds using simplest thermodynamic reasoning, such as the different adiabats and temperatures derived therefrom to simplify the computations. Different condensation levels and the upper edge limit of the convective clouds are covered. Instability indices were tested over central Germany using 130 ascents, in which the best results were obtained by applying a thunderstorm-index. A separation of thunderstorms from mere shower activity, however was not accomplished. It was only possible to separate the days with clouds of the cumulus type from days without development of cumulus clouds of greater vertical extension. Author

N71-24114 National Lending Library for Science and Technology, Boston Spa (England).
ON THE STRUCTURE OF A GROUND INVERSION IN YOKOHAMA
Toshio Minowa 2 Feb. 1971 26 p refs Transl. into ENGLISH from Kishocho Kenkyu Jiho (Tokyo), v. 21, 1969 p 23–26
(NLL-M-20020-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The data on the atmospheric vertical temperature distribution in the surface layer at Yokohama are analyzed to explain the difference in night-time surface temperatures in urban and rural areas. The thermal structure of the ground inversion layer, and the wind effects are discussed. One of the conclusions is that the surface isothermal layer is due to a warm air layer near the surface produced by artificial conditions. The thickness of this warm air layer is estimated to be several tens of meters, and since it is likely that the surface warmth increases the surface concentration of atmospheric pollution, care must be taken in chimney design. F.O.S.

N71-24115# Environmental Science Services Administration, Boulder, Colo. Atmospheric Physics and Chemistry Lab.
INADVERTENT MODIFICATION OF WEATHER AND CLIMATE BY ATMOSPHERIC POLLUTANTS
E. W. Barrett, R. F. Pueschel, H. K. Weickmann, and P. M. Kuhn Sep. 1970 110 p refs
(ESSA-TR-ERL-185-APCL-15) Avail: SOD $1.00

A program of data collection and analysis which has the objective of providing accurate and quantitative facts on: (1) the amounts of anthropogenic contaminants in the atmosphere; (2) the interaction of these contaminants with the natural atmospheric constituents; and (3) the changes in weather and climate resulting from the physical and chemical effects of the contaminants is described. The techniques for measurement of concentrations of gaseous constituents (carbon dioxide, ozone, water vapor, oxidizing and reducing gases), for measurement of amounts of particulate matter, the chemical composition of these aerosols, and their effectiveness as Aitken, cloud-condensation, and ice-particle nuclei are presented. Author

N71-24189 National Lending Library for Science and Technology, Boston Spa (England).
USE OF RHYTHMS IN FORECASTING THE WEATHER IN MAY

G. M. Shushevskaja 24 Jan. 1971 6 p refs Transl. into ENGLISH from Tr. Gidrometeorol. Nauchn.-Issled. Tsentr. SSSR (Leningrad), no. 62, 1970 p 98–101
(NLL-M-20270-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Three and five month rhythms were studied for 10 extremely warm and 17 extremely cold Mays for southern European U.S.S.R. from 1891 through 1967. A correlation between cold Decembers and Februaries and cold Mays, and between warm Decembers and Februaries and warm Mays was noted, and the reliability of using such data in predicting May weather is discussed. N.E.N.

N71-24223 National Lending Library for Science and Technology, Boston Spa (England).
STUDY OF DIFFUSION IN UNDULATING TERRAINS
J. Zeleny 16 Feb. 1971 11 p refs Transl. into Meteorol. Zpravy (Prague), no. 22, 1969 p 72–75
(NLL-M-20310-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The effects of atmospheric diffusion on the pollution of the ground surface in northwestern Bohemia in the Most basin are discussed. The relief of the area is discussed and measurements are presented for wind speed and direction at one height above the ground. A Taylor analysis of the Lagrange description of a particle field in a flowing medium is used for the measurements. Author

N71-24224 Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie und Geophysik.
METEOROLOGICAL DATA. VOLUME 114, NO. 2: DAILY GROUND AND 850-MILLIBAR MAPS OF THE NORTHERN HEMISPHERE FOR 1970 Quarterly Report, 1 Apr.–30 Jun. 1970 [METEOROLOGISCHE ABHANDLUNGEN. BAND 114, HEFT 2: TAEGLICHE BODEN- UND 850-mb-KARTEN DER NORDHEMISPHAERE IM JAHRE 1970. TEIL 2, 2. VIERTELJAHR, 1. APRIL BIS 30. JUNI 1970]
Manfred Geb, Richard Scherhag et al 1970 184 p In GERMAN
(QR-2-Pt-2) Avail: Issuing Activity

Daily surface and 850 mb synoptic charts for the Northern Hemisphere are presented from April through June 1970. The 850 mb charts are drawn for 0000 GMT and the surface charts are for 1200 GMT. F.O.S.

N71-24227# Hawaii Inst. of Geophysics, Honolulu.
RAINFALL OVER OAHU AND LOCATION OF 300 mb TROUGH DURING TRADE WIND REGIME
K. S. Han-Shun-Cheong Oct. 1970 48 p refs
(Contract ESSA-E-140-70(N))
(HIG-70-28) Avail: NTIS

Six years of upper-air data were studied in conjunction with rainfall at representative stations over Oahu to determine the effect of 300 mb troughs on trade wind rainfall. It is found that the larger rainfall amount and variation of rainfall frequencies during winter (October through June) is primarily due to greater frequency of troughs aloft and of heavier rainfall associated with surface disturbances. For the drier region of Oahu, trough-associated rainfall, in the form of a few heavy downpours, is a significant source of precipitation. Author

N71-24265 International Geophysical Year World Data Center A, Asheville, N.C.
HIGH ALTITUDE METEOROLOGICAL DATA, VOLUME 6, NO. 8, AUGUST 1969
1971 187 p refs
Avail: SOD $3.00

Wind and temperature measurements from all available high altitude meteorological sounding data for August 1969 along with computed values for pressure, density, and speed of sound are reported. The local rawinsonde observation nearest the time of the high altitude meteorological sounding is also included. Conjunctive rawinsondes are within plus or minus 6 hours of the high altitude sounding data. Author

N71-24272 National Lending Library for Science and Technology, Boston Spa (England).
THE EFFECT OF THE CENTRAL RUSSIAN UPLANDS ON THE FORMATION OF CUMULUS CLOUDS IN AN ANTICYCLONE
V. A. Bugaev 16 Feb. 1971 6 p refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), 1969 p 43–46
(NLL-M-20005-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The cloud pictures taken by the meteorological satellite Meteor - 1 over the central European USSR in an anticyclonic situation are discussed. The cloud field breaks off quite sharply at 40 E; this eastern boundary is parallel to the general eastern boundary of the Central Russian uplands and an extensive zone of convection formed in the anticyclone. Convection was stimulated by the rising air currents crossing the uplands. The same currents also produced the breaking up of clouds into banks and the formation of extensive waves perpendicular to the flow. Author

N71-24334 National Lending Library for Science and Technology, Boston Spa (England).
COMPARISON OF ATMOSPHERE CIRCULATION CHARACTERISTICS OVER THE NORTHERN HEMISPHERE AND OVER ITS SECTORS Appendix. Revised
B. I. Dzerdzeevskij 11 Dec. 1970 13 p refs Transl. into ENGLISH from the book 'Circulation Mechanisms in the Atmosphere of the Northern Hemisphere in the 20th Century (Statistical Data Entire Hemisphere and 6 Sectors)' Moscow, Nauka, 1970 p 9–18
(NLL-M-20076-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A revised version of atmospheric circulation and its long term variations in different periods over the Northern Hemisphere and its sectors are discussed. The elementary circulation mechanism is explained in detail. E.H.W.

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N71-23233# Department of Transportation, Washington, D.C. Air Traffic Service.
INDEX OF STANDARD INSTRUMENT APPROACH PROCEDURES
4 Feb. 1971 151 p
Avail: NTIS

An index of standard instrument approach procedures is presented. The procedures are current up to and including 4 February, 1971. Information is presented for airports in the continental United States, Alaska, and the Caribbean area. Author

N71-23288* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AZIMUTH LAYING SYSTEM Patent
Herman E. Thomason and Carl H. Mandel, inventors (to NASA) Issued 10 Dec. 1968 (Filed 25 Sep. 1964) 9 p Cl. 74-5.47
(NASA-Case-XMF-01669; US-Patent-3,415,126; US-Patent-Appl-SN-399419) Avail: US Patent Office CSCL 17G

An azimuth alignment system for a stable platform is described. A synchro transmitter assembly is mounted on an end of the

platform's gimbal axle with its stator and rotor coaxial to the gimbal axle. The rotor is rigidly connected to the gimbal axle whereby rotation of the platform about the axis of the gimbal axle will rotate the rotor. A first prism is mounted on the stable platform and a second prism is mounted on the transmitter's stator. A theodolite is provided to establish the initial position of the stable platform by aligning the prisms along a known line. Control means are also provided for rotation of the stable platform about the gimbal axle according to a predetermined time function azimuth program based on the initial alignment of the stable platform.

Official Gazette of the U.S. Patent Office

N71-23356# Royal Aircraft Establishment, Farnborough (England).
RADIO ENVIRONMENT MONITORING FOR THE CATEGORY 3 INSTRUMENT LANDING SYSTEM
T. R. G. Lampard May 1970 74 p refs
(RAE-TR-70076) Copyright. Avail: NTIS

The need for integrity monitoring of the category 3 instrument landing system when used for automatic landing is discussed. A radio environment monitoring system is proposed, based on early experimental work carried out at Farnborough and London Airport. The practical results obtained support the theoretical work in such a way as to indicate that the method of monitoring is a viable proposition. Author (ESRO)

N71-23361# Royal Aircraft Establishment, Farnborough (England).
DETERMINATION OF CPILS LOCALISER BEAM NOISE
J. Benjamin Jul. 1970 41 p refs
(RAE-TR-70141) Copyright. Avail: NTIS

A method of estimating the magnitude of residual beam noise resulting from reflected interference is given for the CPILS localizer configuration. Author (ESRO)

N71-23717# British Aircraft Corp. (Operating) Ltd., Bristol (England).
A STUDY OF DUAL-SPIN STABILITY
M. Brewer, R. Bushell, J. Holt, and N. Swift Paris ESRO Nov. 1970 191 p refs Sponsored by ESRO
(Contract ESTEC-900-70-SL)
(ESRO-CR-24) Avail: NTIS

The study involved theoretical analysis of the nutation damping stability of a dual spin stabilization system and the derivation of criteria for the stability of both controlled and uncontrolled platform despin cases. The analysis shows that, for the case of prime interest in which the platform is despun to a near-zero rate, a sufficiently powerful platform mounted passive damper will interact with the despin control motor to give stability, regardless of the inertial properties of the spacecraft, except that the rotor spin axis must also be a nominal principal axis. The study also included simulation work, both as a back-up to the theoretical analysis and as a means of investigating parametrically the properties of a dual-spin system and the influence of errors and defects likely to be found in practice. The comparison between the theoretical and simulation results has proved to be satisfactory, so that considerable confidence in the validity of the work and the dual-spin concept has resulted. Author (ESRO)

N71-23842# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INERTIAL NAVIGATION
Yu. Hang 23 Nov. 1970 11 p Transl. into ENGLISH from Hang K'ung Chih Shih (Communist China), no. 3, 1965 2 p
(AD-718625; FTD-HT-23-577-70) Avail: NTIS CSCL 17/7

The use of gyroscopes as end instruments of sea navigation compasses, direction finders, gyrohorizons, and automatic pilots on aircraft already has a history of several decades. The so-called accelerometer, which utilizes the principle of inertia to measure the acceleration of a moving body, has also been well-known for some time. However, inertial navigation systems (called inertial guidance systems in rocket technology) which are composed of gyroscopes, accelerometers, and electronic computers have only been on the market for a little over twenty years. In the past twenty years, inertial navigation technology has developed rapidly, and the precision of inertial navigation has increased greatly. In 1944, the V-2 rocket made the first use of an inertial guidance system. Its range was 320 kilometers and its deviation from impact on target was approximately 1.6 kilometers. But now the range of long-range ballistic rockets has reached 10,000 kilometers, and even though they still use inertial guidance systems, because the precision of inertial elements has been greatly increased the deviation from impact on target is still only about 2 kilometers. GRA

N71-23843# Naval Research Lab., Washington, D.C.
USE THE ATTITUDE SENSORS TO DETERMINE THE MOTION OF A FREE ROTATOR
Julian C. Holmes 7 Jan. 1971 30 p
(AD-718314; NRL-7194) Avail: NTIS CSCL 17/7

From the free-body representation of Poinsot and expressions derived therefrom for the behavior of a body free from internal and external torques, the practical determination of the parameters of rocket or satellite motion has been considered. Transient perturbing torques can result in unique free motion patterns. A small number of measurements using rocket-mounted devices can determine free-body motion, with or without knowledge of the moments of inertia. These devices are magnetometers that measure the earths field and telescopic instruments that view stars or the sun. Digital computer programs have proved useful for analyzing signals from rocket-borne attitude sensing devices. These include two scopic sensor across the bright object map and a program which uses magnetometer and star signals to locate the azimuth of a rocket free-body precession cone about the earth's magnetic field direction.

Author (GRA)

N71-23967*# Techtran Corp., Glen Burnie, Md.
ESRO HAS BEGUN THE INITIAL STUDIES FOR A EUROPEAN SYSTEM OF AIR TRAFFIC CONTROL VIA SATELLITE [L'ESRO A LANCE LES PREMIERES ETUDES D'UN SYSTEME EUROPEEN DE CONTROLE DU TRAFIC AERIEN PAR SATELLITE]
Jacques Morisset Washington NASA May 1971 5 p refs Transl. into ENGLISH from Air et Cosmos (France), no. 363, 10 Apr. 1971 p 15
(Contract NASw-2037)
(NASA-TT-F-13651) Avail: NTIS CSCL 22A

The progress of European development of a UHF air traffic control satellite under the direction of ESRO is examined in the light of American decisions regarding cooperation. Author

N71-24007# Massachusetts Inst. of Tech., Cambridge. Measurement Systems Lab.
ALIGNMENT AND CALIBRATION OF A STRAPDOWN INERTIAL MEASURING UNIT
Timothy J. Ryan Dec. 1970 133 p refs
(Contract DOT-TSC-143)
(RE-67) Avail: Issuing Activity

A self contained process of calculating the direction cosine transformation that relates the axes in the strapdown inertial measurement unit to the local geographic coordinates is discussed. Three alignment methods are analyzed. They are: (1) the open loop method using accelerometer and gyro measurements, (2) the closed loop method using a strapdown gyrocompass and (3) optical filtering techniques. Predictions of and actual instrument drift are given in graphical form. Author

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N71-23139# General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.
TWO PHASE FLOW AND HEAT TRANSFER IN MULTIROD GEOMETRIES Quarterly Progress Report, 1 Apr.–30 Jun. 1970
Jul. 1970 40 p refs
(Contract AT(04-3)-189)
(GEAP-10253; QPR-19) Avail: NTIS

Multirod critical heat flux (CHF) data were obtained, using an array of nine uniformly heated rods held in their correct positions in a square channel by means of five grid-type spacers typical of modern water-cooled and moderated power reactors. Five combinations of axial position of heated length in relation to end of channel, and axial position of spacers with respect to end of heated length, were tested at various mass velocities and pressures. The effect on CHF of moving the end of the heated length from a position 2 inches before the end of the channel (test channel No. 4) to a position 3 1/2 feet before the end of the channel (test channel No. 2) was to reduce the CHF at low qualities. The effect on CHF of moving the last spacer from a position just past the end of the heated length (test channel No. 2) to a position just before the end of the heated length (test channel No. 1) was generally to raise the CHF, particularly at low qualities and high flows. Author (NSA)

N71-23140# Sanders Nuclear Corp., Nashua, N.H.
DEVELOPMENT OF THE SIREN CAPSULE, PHASE 1A Final Report, Sep. 1969–Jan. 1970
Robert W. Anderson and H. Eugene Rexford 1970 54 p
(Contract AT(29-2)-2708)
(SNC-2708-2) Avail: NTIS

Various parameters that affect the impact resistance of the Siren capsule were studied for a nonmetallic encapsulation system for radioisotopic heat sources. A series of 22 Siren test capsules were fabricated and impact tested. Relative impact resistance of the respective capsules was based on the condition of the simulated fuel core, the condition of the graphite structural shell, and the degree of post impact containment. Evaluation of the test data showed that solid cores of the ThO_2-Mo fuel simulant can be impacted intact when protected by the Siren capsule. It was also found that higher strength graphite yarn can improve the impact resistance of the structural shell and that post impact containment of the fuel core could be provided by three independent methods. Author (NSA)

N71-23141# Gulf General Atomic, San Diego, Calif.
THERMODYNAMIC DATA FOR CARBONACEOUS SYSTEMS
P. Winchell 20 Nov. 1970 46 p refs
(Contracts AT(04-3)-167; AT(04-3)-633)
(GAMD-9335) Avail: NTIS

An updated compilation and evaluation of thermodynamic data for carbonaceous materials which are used in high-temperature reactor technology is presented. For some systems experimental data are not available; in these cases estimates are given. NSA

N71-23194# Argonne National Lab., Ill.
CHEMICAL ENGINEERING DIVISION FUEL CYCLE TECHNOLOGY Quarterly Report, Jul.–Sep. 1970
D. S. Webster, A. A. Jonke, G. J. Bernstein, N. M. Levitz, R. D. Pierce et al Oct. 1970 55 p refs
(Contract W-31-109-eng-38)
(ANL-7755) Avail: NTIS

Work has been done during the period July through September 1970 on fuel cycle technology projects in the following areas: (1) development of a head-end process for LMFBR fuels, consisting of removal of stainless steel cladding in a zinc bath and subsequent reduction of the fuel oxide to metal, (2) laboratory-scale and pilot-scale work to develop a fluid-bed process for the conversion of uranium nitrate and plutonium nitrate solutions to an oxide form suitable for the fabrication of fuel shapes for LMFBR fuel, (3) development of x-ray fluorescence spectrometry as an in-line analytical method for determining the Pu/U ratio of oxide fuels during fabrication, and (4) development of a centrifugal contractor of small diameter and large length-to-diameter ratio for the plutonium isolation steps in the solvent extraction of LMFBR fuels. Author (NSA)

N71-23196# Florida Univ., Gainesville. Engineering and Industrial Experiment Station.
QUANTITATIVE DETERMINATION OF THE STRUCTURE: PROPERTY RELATIONSHIPS IN NUCLEAR FUEL ELEMENT MATERIALS Quarterly Progress Report, 15 Sep.–15 Dec. 1970
F. N. Rhines, R. T. De Hoff, and E. D. Whitney Dec. 1970 22 p
(Contract AT(39-1)-552)
(SRO-552-8) Avail: NTIS

Continued experimental progress has been achieved in the areas of quantitative microstructural analysis, gas permeability studies, short time mechanical properties, and thermal conductivity measurements on both sintered nickel and sintered uranium dioxide powders. In broad terms, the path of microstructural change followed by both powders, and the dependence of properties upon geometric state, may be predicted on the basis of the results of earlier work on copper sinterings. Author (NSA)

N71-23258*# NUS Corp., Rockville, Md.
UNMANNED SPACECRAFT RTG SHIELD OPTIMIZATION STUDY Final Report
J. J. Steyn and R. Huang May 1970 166 p refs
(Contract NAS5-11649)
(NASA-CR-117898; NUS-679) Avail: NTIS CSCL 18F

The development of analytic procedures and computer codes are discussed for the prediction of weight optimized radioisotope thermoelectric generator shields for unmanned spacecraft operating in vacuo. An optimization code: SOSC, designed to determine shield optimum weights and dimensions with respect to specified criterion fast neutron plus gamma photon fluxes, is described. The code employs a combination of analytic, albedo and Monte Carlo techniques. A theoretical discussion and example predicted shield data are given as well as a proposed verifying experiment design. Author

N71-23439*# Resalab Scientific, Menlo Park, Calif.
TECHNICAL, ANALYTICAL, AND COMPUTER SUPPORT Annual Report, 18 Feb. 1970–17 Feb. 1971
17 Feb. 1971 93 p refs Prepared for JPL
(Contract NAS7-100; JPL-952808)
(NASA-CR-118008) Avail: NTIS CSCL 18E

The work performed during the period 18 February 1970 to 17 February 1971 is reported. The bulk of the work effort during this time period was divided into three specific tasks. These were RTG design study, material study, and special studies. An additional task, the sublimation of silicon-Germanium alloys was initiated. The RTG Design study involves the development of a rigorous mathematical model for the design and performance analysis of cylindrical silicon-germanium Thermoelectric Generators (RTG's) and consists of two parts, a steady-state (static) part and a transient (dynamic) part. The material study involves the definition and implementation of a material study that aims to experimentally

characterize the long-term behavior of the thermoelectric properties of silicon-germanium alloys as a function of temperature. The sublimation of silicon-germanium alloy consists of analytical and experimental efforts aimed at the determination of the sublimation characteristics of these alloys and the study of sublimation effects on RTG performance. The special studies involve studies performed at JPL's request on a variety of specific topics on thermoelectric energy conversion. Author

N71-23599* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THERMIONIC CONVERTER WITH CURRENT AUGMENTED BY SELF INDUCED MAGNETIC FIELD Patent
Alex Vary, inventor (to NASA) Issued 16 Jul. 1968 (Filed 24 Jun. 1965) 6 p Cl.310-4
(NASA-Case-XLE-01903; US-Patent-3,393,330;
US-Patent-Appl-SN-466868) Avail: US Patent Office CSCL 18E

A thermionic converter having an electron emitting electrode and a collector electrode disposed in spaced relationship in an envelope, a load being connected between the electrodes is described. The collector electrode comprises a pair of comb like elements having intermeshed segments defining alternately narrow and wide spaces. The electrode also has electrons reaching the collector flow in opposite directions in adjacent segments to produce a magnetic field which aids electron flow from emitter to collector. Official Gazette of the U.S. Patent Office

N71-23844# Argonne National Lab., Ill.
REACTOR DEVELOPMENT PROGRAM Progress Report, Dec. 1970
19 Jan. 1971 98 p refs
(Contract W-31-109-eng-38)
(ANL-7765) Avail: NTIS

Highlights of project activities for December 1970 are summarized. LMFBR physics development and component development are reviewed. Operations and analysis of ZPR-3, ZPR-6, ZPR-9, and ZPPR are described. The EBR-2 research and development projects and operations are summarized. Reactor fuels and materials development, engineering development, fuel cycle chemistry, and LMFBR safety studies are reported. NSA

N71-23845# Gulf Radiation Technology, San Diego, Calif.
FAST REACTOR SPECTRUM MEASUREMENTS Quarterly Progress Reports, Period Ending 31 Oct. 1970
J. C. Young, G. M. Borgonovie, and K. L. Crosbie 18 Nov. 1970 36 p refs
(Contract AT(04-3)-167)
(GULF-RT-10421) Avail: NTIS

Time-of-flight measurements were made in STSF-7. These included spectrum measurements in the core, at the core-reflector interface, and in the reflector. Auxiliary measurements were also made of the diesway of the system, and activation foils were used to determine the U-235/U-238 fission ratio. Calculations of the kinetics of the system using the computer code CAGE-2 were performed and compared to the measured data. The He-3 neutron spectrometer was placed in the STSF-7 core to measure the static spectrum as a check of this detector system. The design of STSF-8 was finalized and internal approvals were obtained to convert STSF-7 to STSF-8. The response function measurements for the proton recoil detectors were completed and the analysis of these data is well under way. Calculations were performed to compute the analytical response function for these detectors. The spectra measured in STSF-7 were partially analyzed and are reported. Author (NSA)

N71-23847# Braun (C. F.) and Co., Alhambra, Calif.
PHILOSOPHY AND CRITERIA OF THE DESIGN GUIDE FOR LMFBR SODIUM PIPING
2 Oct. 1970 46 p refs
(Contract AT(04-3)-781)
(SAN-781-500) Avail: NTIS

The philosophy and criteria adopted for the first issue of the Design Guide for LMFBR Sodium Piping are described. Topics discussed include: LMFBR piping design; stress categories; primary stresses; secondary stresses; thermal stress ratchet; peak stresses and fatigue; and inelastic analysis. NSA

N71-23856# Braun (C. F.) and Co., Alhambra, Calif.
STUDY OF MODEL TEST METHODS AS RELATED TO LMFBR PIPING SYSTEMS
6 May 1970 128 p refs Prepared in cooperation with TRW Systems Group
(Contract AT(04-3)-781)
(SAN-781-234) Avail: NTIS

Model testing methods for LMFBR piping systems are described. Nine methods discussed include: photoelasticity, moire grid method, X-ray diffraction, strain gage, brittle coatings, acoustoelasticity, extensometers, holographic interferometry, and scale models. NSA

N71-23890 Washington Univ., Seattle. Dept. of Chemical Engineering.
PACKED BED REACTOR ANALYSIS BY ORTHOGONAL COLLOCATION
Bruce A. Finlayson Sep. 1970 34 p refs
(Grant NSF GK-3083)
Avail: Issuing Activity

The equations governing a packed bed reactor with radial temperature and concentration gradients are solved using the orthogonal collocation methods. The method is faster and more accurate than finite difference calculations. Using the orthogonal collocation method it is straightforward to extend one-dimensional (lumped parameter) models to the two-dimensional models needed when radial temperature and concentration gradients are important. The two-dimensional model is necessary for large Biot numbers. For Biot numbers less than one, 75% of the resistance to heat transfer is at the wall, and a one-dimensional treatment gives good results. Computations are illustrated for both plug glow and radially-varying velocity. In the latter case the velocity profile induces effective thermal conductivity and diffusivity profiles. Calculations made using the velocity profile predict a heat transfer coefficient which is used in the plug flow model. Good agreement is obtained between the models. Author

N71-23891# Bettis Atomic Power Lab., Pittsburgh, Pa.
SPACE TIME METHODS FOR MOVABLE FUEL PROBLEMS: LWBR DEVELOPMENT PROGRAM
J. B. Yasinsky and L. R. Foulke Dec. 1970 21 p refs Presented at Symp. on Dynamics of Nucl. Systems, Tucson, Ariz.
(Contract AT(11-1)-gen-14)
(WAPD-TM-968; CONF-700304-5) Avail: NTIS

The need for a three-dimensional space-time computational capability for the design and analysis of a movable fuel controlled power reactor is examined, and the reasons leading to the selection of the space-time synthesis model over other existing space-time models is discussed. The mechanics for treating movable fuel and delayed neutron precursors within this model is outlined, and improvements that have been made in the associated spatial differencing model that result in improved accuracy are discussed. Author (NSA)

N71-23892# Oak Ridge National Lab., Tenn.
HIGH FLUX ISOTOPE REACTOR Quarterly Report, Jul. Sep. 1970
R. V. McCord and B. L. Corbett 19 Jan. 1971 26 p ref Sponsored by AEC
(ORNL-TM-3286) Avail: NTIS

Operations and maintenance requirements for the reactor during July to September 1970 are described. System surveillance tests and design changes are discussed. Experimental work in the reactor is reviewed. NSA

N71-23907*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
GAS CORE ROCKET REACTORS: A NEW LOOK
Robert G. Ragsdale and Edward A. Willis, Jr. [1971] 17 p refs Presented at the 7th Propulsion Joint Specialist Conf., Salt Lake City, 14–18 Jun. 1971; sponsored by AIAA
(NASA-TM-X-67823) Avail: NTIS CSCL 18E

The current status of research on the feasibility of an open-cycle gas-core nuclear rocket engine is presented. The material is based on continuing studies that include: (1) reactor critical experiments, (2) cold and hot flow tests, and (3) both experiments and analyses to determine compositions and gas opacities at reactor conditions. The findings indicate that the use of a space radiator may permit attainment of specific impulse ranging from 2500 to 6500 seconds, for engine thrusts ranging from 20,000 to 400,000 newtons, and engine pressure ranging from 0.5×10 to the 8th power to 2×10 to the 8th power newtons per square meter. Mission application studies show that this class of rocket engines are capable of 80-day roundtrip missions to Mars with the engine and command module reinserted into the starting orbit at Earth. Author

N71-23928*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL EVALUATION OF THE ELECTRICAL SUBSYSTEM OF THE 2 TO 15 kW BRAYTON POWER CONVERSION SYSTEM
R. R. Secunde, J. E. Vrancik, and A. C. Spagnuolo [1971] 16 p refs Proposed for presentation at 1971 Intersoc. Energy Conversion Eng. Conf., Boston, 3–6 Aug. 1971; sponsored by SAE
(NASA-TM-X-67814) Avail: NTIS CSCL 18L

The electrical subsystem, powered by a motor-driven alternator, was evaluated under various system operating conditions in a vacuum environment in order to determine overall performance. Continuing studies include a 10,000 hour endurance test in vacuum to verify the ability of the subsystem to function properly during long term operation in space. Overall operation of the subsystem was satisfactory. Deviations of system waveforms from a true sine wave have a small but measurable effect on the performance of individual components. Operation of the speed controller has a distorting effect on the 1200 hertz system voltage. The life of the originally selected silver-cadmium batteries was inadequate for long-term use in the Brayton power conversion system. Author

N71-23947# Braun (C. F.) and Co., Alhambra, Calif.
REVIEW OF IN-SERVICE SURVEILLANCE METHODS APPLICABLE TO LIQUID SODIUM PIPING
7 Jan. 1970 57 p refs
(Contract AT(04-3)-781)
(SAN-781-243) Avail: NTIS

In-service surveillance requirements for LMFBR piping systems are described. Information on various types of surveillance methods is compared. Topics discussed include: sodium leak detection; pipe movement; alignment and vibration; material inspection; strain measurement and crack detection; and logging of records. Advantages and disadvantages of the various surveillance methods are outlined. Author (NSA)

N71-23988# Argonne National Lab., Ill.
APPARATUS FOR HIGH SPEED PHOTOGRAPHIC EXPERIMENTS WITH IRRADIATED FAST REACTOR FUEL SPECIMENS
L. E. Robinson and C. August Aug. 1970 23 p refs
(Contract W-31-109-eng-38)
(ANL-7578) Avail: NTIS

The standard, transparent TREAT fuel-meltdown facility was redesigned for experimental use with irradiated fast-reactor fuel specimens. The stainless steel slot liner was formed of a single sheet, with integral ribs rolled in, for greater rigidity and ease of fabrication. The redesigned test capsule has a fuel-holding frame automatically locked in position during remote loading. A Zircaloy auxiliary lining was added to ease decontamination and increase the reusability of the facility. A removable auxiliary flange was used to centralize inert gas and electrical connections and to clamp the refractory lining to the slot liner. An in-line, remotely operated assembly apparatus was designed to permit remote handling, spot welding, and fuel loading. Author (NSA)

N71-23987# Braun (C. F.) and Co., Alhambra, Calif.
SUMMARY OF RESEARCH AND DEVELOPMENT RECOMMENDATIONS FOR LMFBR PIPING
1 May 1970 42 p refs
(Contract AT(04-3)-781)
(SAN-781-518) Avail: NTIS

Research and development programs which are considered prerequisite to the establishment of design procedures which provide adequate assurance of the safe design and operation of LMFBR piping are summarized. An attempt was made to categorize the recommended R & D programs as to their relative priorities. These categories are as follows: first priority short-term ivestigations; first priority long-term investigations; second priority investigations; and investigations of peripheral interest. Each program is described in its appropriate category, with a brief background discussion and a proposed course of action. Author (NSA)

N71-24054# WADCO Corp., Richland, Wash.
REACTOR ENGINEERING DEVELOPMENT. REACTOR ENVIRONMENT EFFECTS ON SIGNAL CABLES Progress Report, Jun.–Aug. 1970
J. L. Stringer Dec. 1970 33 p refs
(Contract AT(45-1)-2170)
(WHAN-IR-42) Avail: NTIS

Measurements of the radiation-induced noise in a pulsed TRIGA Reactor showed the noise to be proportional to the induced insulator conductivity, but not to the induced direct current. The independence of the noise magnitude of cable dimensions noted in Co-60 experiments can be extended to include a combined neutron and gamma flux. The absence of the induced direct-current proportionality supports a model based on the amplitude and time distributions of the instantaneous positive and negative currents. The ac and dc shunt resistance values for Cable 5E were measured with dc bias voltages of 10, 300 and 600 V dc applied over a temperature range of 1100 to 1500 F. Insulator polarization caused variations in the dc resistance of almost a factor of ten at 1100 F, reducing to about a factor of four at 1500 F. The general slope of the data suggests an interaction of the dc and ac resistance values above 1500 F. Author (NSA)

N71-24055# United Nuclear Corp., Elmsford, N.Y. Research and Engineering Center.
PIPING MATERIALS FOR LMFBR PLANTS
22 May 1970 244 p refs Prepared in cooperation with Braun (C. F.) and Co. Revised
(Contract AT(04-3)-781)
(SAN-781-228-Rev-1; TR-228-Rev-1) Avail: NTIS

The effects of LMFBR environmental conditions on Type 304 and Type 316 stainless steels and Cr–Mo alloy are analyzed. The piping materials are studied for corrosion and erosion and changes in mechanical properties. NSA

N71-24073# Arizona Univ., Tucson. Dept. of Nuclear Engineering.
ANALYTICAL AND EXPERIMENTAL STUDIES RELATING TO THE SIMULATED START-UP OF IN-CORE THERMIONIC REACTOR SYSTEMS
James Garfield Guppy Jun. 1970 201 p refs
(Contract AT(04-3)-670)
Avail: NTIS

An analytical representation of a nuclear reactor containing in-core thermionic devices suitable for transient studies is formulated. The resulting model is applicable to situations involving substantial changes in system operating conditions, as would be experienced during start-up transients. Neutron kinetics and heat transfer are represented by nodal descriptions. Contributions from all system regions of importance are retained to produce realistic transient response. The resulting set of equations is coupled to a digital computer integration routine to solve for the dynamic response. The thermionic converter physics is described by a complex iterative numerical scheme based on a diffusion approximation to the plasma processes. Other thermionic processes included are surface and Schottky effects, plus an accounting of the electrostatic sheaths present. The analysis is extended to include general application to thermionic diodes undergoing transients. Author

N71-24102 National Lending Library for Science and Technology, Boston Spa (England).
MANUFACTURE OF NUCLEAR FUEL ELEMENTS AT CERCA [LA FABRICATION DES ELEMENTS COMBUSTIBLES NUCLEAIRES A LA CERCA]
M. Pollet 18 Jan. 1971 11 p Transl. into ENGLISH from Energie Nucl. (Paris), v. 12, no. 4, Jul.–Aug. 1970 p 327–330 In ENGLISH and FRENCH
(NLL-Windscale-453-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The fabrication of laminated and ceramic fuel elements is described, and the assembling steps are outlined. For the laminated elements the fissile cores are obtained by casting or sintering, and the core, between two aluminum sheets, is hot rolled then cold rolled. The ceramic fuel elements for the SENA reactor, moderated with pressurized light water, are composed of 208 fuel pencils. N.E.N.

N71-24103 National Lending Library for Science and Technology, Boston Spa (England).
ELECTRICALLY SIMULATED FUEL ELEMENTS WITH HEAT TRANSFER INSTRUMENTATION
Ch. Engler 22 Oct. 1970 7 p Transl. into ENGLISH from Neue Tech., B2 (Switzerland), v. 2, 1969 p 87–91
(NLL-RISLEY-Trans-1803-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The problem of simulating the thermal effects of fuel elements is illustrated for an element with finned magnesium cladding for a carbon dioxide cooled reactor. Details are given on the electric heater whose main component is an Inconel 600 resistance tube. The preparation of the finned tube is outlined, and 12 sheathed thermocouples are embedded in it to simulate the fuel. Cladding tubes of low alloy magnesium are pressurized hot with argon as the pressurizing medium. N.E.N.

N71-24152# WADCO Corp., Richland, Wash.
COMPARISON OF THE CODES RSYN AND 3DB
N. J. McCormick and R. W. Hardie Dec. 1970 28 p refs
(Contract AT(45-1)-2170)
(WHAN-IR-48) Avail: NTIS

The Codes RSYN and 3DB were recently developed for the computation of fluxes and associated bulk parameters of fast reactors using three dimensional diffusion theory. The R(eactor) SYN(thesis) code is based upon a spatial differencing of the matrix equations arising from a synthesis in one dimension of time independent results calculated from a two dimensional diffusion theory code. On the other hand, static calculations using the 3 D(imensional) B(umup) code are based upon standard source iteration techniques, which are initiated with an initial fission source distribution and which utilize group rebalancing and successive line over-relaxation to accelerate convergence. The features and present operational status of RSYN are described. The utility of the codes for a series of (model) problems is discussed. Author (NSA)

N71-24153# Bettis Atomic Power Lab., Pittsburgh, Pa.
IN-PILE DIMENSIONAL CHANGES OF THE ThO2-UO2 FUEL RODS WITH NON-FREE STANDING CLADDING (LWBR DEVELOPMENT PROGRAM)
J. F. Giovengo Nov. 1970 32 p refs
(Contract AT(11-1)-Gen-14)
(WAPD-TM-986) Avail: NTIS

Test data obtained from irradiation of bulk oxide Zircaloy clad fuel rods was evaluated to determine the effect of several geometrical and environmental test variables on the observed post-irradiation dimensional changes. The major variables include clad-heat treatment, fast flux, pellet end configuration, fuel center temperature, clad diameter to thickness ratio, accelerated power cycling, and pressure cycles. Data indicate clad heat treatment, fast flux environment, pellet end configuration and fuel center temperature have a large effect on rod elongation believed to be caused by an axial ratchetting mechanism. The other test variables considered show much less of an effect, if any, on the observed dimensional changes resulting from axial ratchetting of the non-free standing Zircaloy-4 cladding. Author (NSA)

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N71-23200# California Inst. of Tech., Pasadena. Antenna Lab.
ELECTROMAGNETIC WAVE PROPAGATION IN A UNIFORMLY ACCELERATED SIMPLE MEDIUM
Tse Chin Mo Nov. 1970 21 p refs
(Grant AF-AFOSR-1400-68)
(AD-717883; AFOSR-70-2733TR) Avail: NTIS CSCL 20/14

The theory of electromagnetic wave propagation in a uniformly accelerated simple medium is generalized to cover the case of arbitrary initial wave direction. The wave splits into two natural modes relative to the plane of acceleration and the wave vector. The case of high frequency and weak acceleration is solved in detail, demonstrating to observers at rest w.r.t. the medium a drag effect due to apparent gravity, and to inertial observers a drag effect due to medium acceleration. A preferred asymptotic cone of propagation determined by square root(mu epsilon-1) is found in the accelerated frame. Various drag effects are physically interpreted. Author (GRA)

N71-23248# Massachusetts Inst. of Tech., Cambridge. Acoustics and Vibration Lab.
AN INVESTIGATION OF THE NEAR WAKE PROPERTIES ASSOCIATED WITH PERIODIC VORTEX SHEDDING FROM AIRFOILS
Carl E. Hanson Sep. 1970 82 p refs
(Contract Nonr-3963(26))
(AD-718893; A/V-76234-5) Avail: NTIS CSCL 20/1

An investigation of the near wake of airfoils with various trailing edge configurations including splitter plates reveals properties which are conducive to wake periodicity. The frequency of the shedding process is found to scale with the near wake momentum thickness and a wake velocity simply related to the base pressure

coefficient. Computer results suggest that the frequency and bandwidth of the vortex shedding process can be predicted by a solution of the complete Orr-Sommerfeld equation. Author (GRA)

N71-23285# Joint Publications Research Service, Washington, D.C.

PRODUCTION AND USE OF FERRITES

N. D. Gorbunov et al 23 Apr. 1971 58 p Transl. into ENGLISH from the book 'Spravochnik. Ferrity i Magnitodielektriki' Moscow, 1968 p 13-21; 99-105; 122-154

(JPRS-52952) Avail: NTIS

Several different methods, depending on the technology utilization, chemical composition, and the material being used, are described for the production of oxide magnetically soft, hard, and magnetostrictive ferrites. Mechanical properties, machining, cutting, plane grinding, mounting, and cementing techniques are discussed in detail. The equipment used in each process is described. E.H.W.

N71-23328# Naval Underwater Systems Center, New London, Conn.

THE ATTENUATION OF UNDERWATER SOUND: A REVIEW OF EXPERIMENTAL AND THEORETICAL INVESTIGATIONS

Richard B. Lauer 2 Nov. 1970 36 p refs

(AD-718330; NUSC/NL-4025) Avail: NTIS CSCL 20/1

Experimental and theoretical investigations of the attenuation of underwater sound are reviewed. The historical development followed invited a separation of the study into three frequency ranges: frequencies above 1000 kHz, frequencies between 10 and 1000 kHz, and frequencies below 10 kHz. The known or postulated primary mechanisms of attenuation, namely, viscosity, magnesium sulfate relaxation, and the structural relaxation of water molecules, are discussed. Empirical and theoretical expressions for the attenuation coefficient in sea water are given in terms of the frequency and the environmental parameters of temperature and pressure. Author (GRA)

N71-23338# Advisory Group for Aerospace Research and Development, Paris (France).

ACCELERATION TERMINOLOGY: TABLE OF COMPARATIVE EQUIVALENTS

G. J. Pesman *In its* Principles of Biodynamics Applicable to Manned Aerospace Flight Prolonged Linear and Radial Acceleration Mar. 1971 p 1-6 refs (See N71-23337 12-05)

Avail: NTIS

Development of vertical or steep landing and takeoff aircraft, helicopters, and space vehicles has destroyed the comfortable situation in which the vehicle and occupants maintained a fixed relationship. With the advent of these advances, it became desirable that essentially two directional terminologies be used, one for the vehicle and another for the occupants. Terms were evolved, and as far as possible, have been incorporated into revised tables of equivalent terminology for both linear and angular motion. Tables of comparative equivalents are presented which are organized into the form of a statement of the laws of motion. A.L.

N71-23340# Advisory Group for Aerospace Research and Development, Paris (France).

THE DYNAMICS OF ROTATION APPLIED TO CENTRIFUGES

R. E. van Patten *In its* Principles of Biodynamics Applicable to Manned Aerospace Flight Prolonged Linear and Radial Acceleration Mar. 1971 p 25-36 (See N71-23337 12-05)

Avail: NTIS

An intuitive, graphical, and simplified mathematical treatment is presented on the subject of rotational dynamics as applied to human centrifuges. This approach was taken in order to relieve physicians and medical personnel of the labor required to gain a rigorous insight into the subject, and to strip away the non-essentials associated with the classic developments. Definitions are presented of the terms associated with the subject as they are commonly used and misused. Coriolis acceleration is discussed and some examples of Coriolis effects are provided. A.L.

N71-23368# Technische Hogeschool, Delft (Netherlands). Afdeling der Technische Natuurkunde.

CLASSICAL CALCULATIONS CONCERNING THE DOUBLE REFRACTION, OPTICAL ROTATION, AND ABSOLUTE CONFIGURATION OF Te, Se, CINNABAR (HgS), alpha- AND beta-QUARTZ, beta-CRISTOBALITE, $NaNO_2$, $NaClO_3$, AND $NaBrO_3$

Rene Reijnhart (Ph.D. Thesis) 1970 102 p refs

Avail: NTIS

Enantiomorphous properties such as optical rotation of selenium and tellurium crystals in terms of tensor symmetrics, are discussed. It is shown that several phenomena exist which distinguish between crystals belonging to different space groups. A description of some of these phenomena is given and, as an example, the symmetry of the etch figures, which appear on the hexagonal prism faces of tellurium, is analyzed in more detail. ESRO

N71-23374# Pennsylvania State Univ., University Park. Ordnance Research Lab.

THE DESIGN OF A DIGITAL SYSTEM FOR THE REAL TIME PREDICTION OF UNDERWATER SOUND PROPAGATION

Duane C. Tate (M.S. Thesis) 11 Sep. 1970 234 p refs

(Contract N0017-70-C-1407)

(AD-718822; TM-202-04) Avail: NTIS CSCL 9/2

The digital ray and intensity projector (DRIP) was a prototype system design to illustrate the feasibility and usefulness of a system capable of measuring the temperature-depth profile of an ocean area and predicting the effects of this medium on underwater sound propagation. DRIP was designed using standard, commercially available hardware, employing an expendable bathythermograph unit to collect the BT data, a small general purpose digital computer for data processing, a CRT display unit to display the predictions, and a teletypewriter for communication with the system operator. Software was developed implementing sound ray theory techniques to achieve the desired predictions. The system was implemented, a study made to determine the accuracy required of the BT data, and a comparison made between DRIPs predictions and measured data collected for various environmental conditions to determine the accuracy of the systems predictions. Finally, DRIP under went actual sea trials where the systems performed all its functions under actual experimental conditions. Results of the experimental testing of DRIP showed that such a system can reliably predict the distortion effects on sound wave propagation caused by the ocean medium. A system similar to DRIP can prove to be invaluable aid to oceanographic research. Author (GRA)

N71-23386*# Scientific Translation Service, Santa Barbara, Calif.

HYPOTHESES ON LUMINOUS ETHER AND ON AN EXPERIMENT THAT APPEARS TO DEMONSTRATE THAT THE MOTION OF BODIES CHANGES THE VELOCITY WITH WHICH LIGHT PROPAGATES IN THEIR INTERIOR [SUR LES HYPOTHESES RELATIVES A L'ETHER LUMINEUX]

H. Fizeau Washington NASA Apr. 1971 20 p ref Transl. into ENGLISH from Ann. de Chem. et de Phys., 3d Ser., v. 57, Dec. 1957 p 385-404

(Contract NASw-2035)

(NASA-TT-F-13623) Avail: NTIS CSCL 20F

Fresnel's hypothesis to explain light abberation and light waves is discussed. An experiment to determine the possible changes in the speed of light traveling through transparent bodies is presented, as well as the apparatus used for such experiments.

Calculations are presented and results and possible sources of error are discussed. Author

N71-23516# Brookhaven National Lab., Upton, N.Y.
LIFT/DRAG RATIOS FOR MAGNETIC SUSPENSIONS
James R. Powell and Gordon T. Danby Dec. 1970 58 p refs
Sponsored by AEC
(BNL-15420) Avail: NTIS

Magnetic lift drag ratios are calculated for various null flux magnetic suspension designs and are compared to the magnetic lift drag ratio for the conducting sheet suspension. The following conclusions are obtained: (1) Magnetic lift drag ratios of 150 are easily achievable with the null flux suspension. This value includes end effects of track and train loops, nonuniform track current distribution, and eddy current losses. (2) The magnetic lift drag ratio is approximately 10 for the conducting sheet suspension and is inherently limited to this value. (3) If the train is traveling in air at 340 mph, the air drag force is approximately 3,300 lbf for both suspensions. The null flux suspension then has a total drag of 3,900 lbf, compared with 13,300 lbf total drag for the conducting sheet suspension. Thus, in air, the null flux suspension total drag is three times less than the total drag with a conducting sheet. Author

N71-23829*# Techtran Corp., Glen Burnie, Md.
SOUND LEVEL MEASUREMENTS PERCENT BAND AND OCTAVE BAND ANALYSIS OF THE NOISE AND VIBRATION IN INDUSTRIAL INSTALLATIONS [MEDICOES EM NIVEIS GLOBAIS, ANALISE EM FAIXAS DE OITAVAS E EN FAIXA PERCENTUAL DO BARULIKO E DAS VIBRACOES EM INSTALACAO INDUSTRIAL]
L. F. Delbonne et al Washington NASA Apr. 1971 52 p refs Transl. into ENGLISH of Lab. de Acustica e Sonica, Sao Paulo, Brazil, report TR-6910.386
(Contract NASw-2037)
(NASA-TT-F-13604; TR-6910.386) Avail: NTIS CSCL 20A

The results of sound level measurements and analysis at a typical foundry are presented. Nineteen locations were selected throughout the plant to be subjected to the sound analysis. In addition, certain motors and compressors were analyzed for noise vibrations. Conclusions and recommendations based on the study are presented. Author

N71-23836 National Lending Library for Science and Technology, Boston Spa (England).
UNEXPECTED QUALITIES OF FROZEN LIQUID
A. Assovskaya 24 Jan. 1971 3 p Transl. into ENGLISH of Rabochaya Gazeta (USSR), 11 Aug. 1971
(NLL-M-20294-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The unusual properties of chalcogenide glass and its possible uses are briefly mentioned. The glass transmits X-ray to infrared radiation, possesses semiconducting properties, and may be used for videocons and silverless photographic film. N.E.N.

N71-23877*# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
INVESTIGATIONS OF LOW FREQUENCY OSCILLATIONS IN A SPHERICAL COLD CATHODE DISCHARGE IN THE PRESENCE OF A DIPOLAR MAGNETIC FIELD
P. E. Schmidt, R. G. Quinn, and John S. Nisbet 20 Apr. 1970 50 p refs
(Grant NGL-39-009-003)
(NASA-CR-118028; SR-354) Avail: NTIS CSCL 20C

Coherent very low, frequency oscillations have been experimentally investigated by means of probes. Utilizing a single probe, it is found that the maximum of the oscillations is located in the negative glow of the discharge. By means of a two probe technique it is found that there exists a 2m pi phase shift in the angular direction with m = 0 for low discharge currents and m = 1 for high discharge currents. No radial phase shift is observed under any discharge and pressure conditions. A simple theoretical model is developed which explains much of the experimental data. Author

N71-23899# California Inst. of Tech., Pasadena. Antenna Lab.
ELECTROMAGNETIC FIELD AND WAVE PROPAGATION IN GRAVITATION
Tse Chin Mo and Charles H. Papas Jan. 1971 24 p refs
(Grant AF-AFOSR-1400-68)
(AD-718145; AFOSR-70-2875TR; TR-56) Avail: NTIS CSCL 20/10

From the physical 3-vector Maxwell equations for an electromagnetic (EM) field in static gravitation, one examines the artifice of replacing the gravitation by an equivalent medium and one finds modified Debye potentials for an EM wave in a simple, angularly homogeneous, material medium in a Schwarzschild gravity. The fact that these potentials do not obey the generalized scalar wave equation implies that gravitation scatters the vector EM wave and a scalar wave differently. Also, one obtains and solve by perturbation the amplitude and eikonal equations for a high frequency wave in a weak spherical gravitational field. To the order M/r, the state of transverse polarization does not change along a ray path whereas the transverse field amplitudes are modified by the factor exp(M/r) which strengthens the field near the mass. The longitudinal field amplitude, on the other hand, is modified by exp(-M/r). These effects, in principle, may provide a further test of classical EM theory and general relativity. Author (GRA)

N71-23900# Naval Research Lab., Orlando, Fla. Underwater Sound Reference Div.
THE EFFECT OF ELEMENT PACKING ON THE COMPLETE RADIATION PATTERNS OF ARRAYS Interim Report
R. J. Bobber Jan. 1971 23 p refs
(AD-718312; NRL-MR-2206) Avail: NTIS CSCL 17/1

A limited study was made to determine the optimum number, spacing, and configuration of point sources in arrays simulating circular and square continuous-plane radiators. The criteria for comparison of the directivity patterns of the array and the continuous radiator were specified as agreement of each lobe within 1 dB in level and 1 degree in location. Circular and square arrays of both odd and even numbers of point sources arranged in square and hexagonal configurations were investigated. An array was analyzed by reducing it to the equivalent shaded line in the plane of the pattern. A computer then was programmed to produce the pattern of the line. It was found that the pattern of an array of an even number of points arranged at the corners of squares of side 0.2 wavelength simulates that of a plane piston within the prescribed limits, except within a half-wavelength of the array and in the region near 90 degrees to either side of the principal axis. Author (GRA)

N71-23901# North Carolina State Univ., Raleigh. Dept. of Mechanical and Aerospace Engineering.
A FORTRAN PROGRAM FOR THE CLASS 5 FLEXTENSIONAL UNDERWATER ACOUSTIC TRANSDUCER
Ralph A. Nelson, Jr. and Larry H. Royster Dec. 1970 60 p refs
(Contract Nonr-486(11))
(AD-718356; TR-11) Avail: NTIS CSCL 20/1

A mathematical model has been developed for the Class V flextensional underwater acoustic transducer. A computer program corresponding to this model, written in Fortran IV G level for the IBM 360-75, has been developed which can be used to give results for the transducer in a vacuum (or in air). This program can also be run in conjunction with the program developed by Hess,

which gives the pressures on an arbitrary body vibrating with a specified velocity distribution, to obtain the results of the transducer in an acoustical media. Author (GRA)

N71-23902# Naval Research Lab., Orlando, Fla. Underwater Sound Reference Div.

A NEW APPROACH TO SUPERDIRECTIVE ARRAYS Interim Report

A. Z. Robinson 5 Jan. 1971 33 p refs

(AD-718322; NRL-7241) Avail: NTIS CSCL 20/1

The concept of defined nulls in the directional response of arrays and the introduction of electrical delays to achieve the desired placement of the nulls provide a new approach to acoustical superdirective arrays. The shading that results is a variant of binomial shading in that the number of times a given element contributes to the array output is determined by the appropriate binomial coefficient, but the signal from the element undergoes a possibly different electrical delay each time the element contributes. For an end-fire condition, the maximum array gain (assuming isotropic noise) is equal to the square of the number of elements in the array. The methods used yield results for three- and five-element broadside arrays that are equivalent to those obtained earlier by R. L. Pritchard. The type of array described responds to a higher order gradient of the pressure field rather than to the pressure field itself. A digital method for implementation of such an array is presented. Author (GRA)

N71-23904# Army Electronics Command, Fort Monmouth, N.J.

DIFFRACTIONAL FIELD DISTORTION AND CROSS TALK IN GUIDED OPTICAL MULTIBEAM TRANSMISSION

J. R. Christian, G. Goubau, J. W. Mink, and F. Schwering Dec. 1970 29 p refs

(AD-718615; ECOM-3369) Avail: NTIS CSCL 20/6

Simultaneous transmission of several off-axis Gaussian beams through a lens-type beam waveguide is subjected to distortions caused by diffraction at the lens apertures and by imperfections of the lenses. The report is concerned with the diffraction effects which are inherent to the performance of beam waveguides and independent of the technological progress in producing high quality lenses. Theoretical information on the diffractional distortions of off-axis beams and the resulting cross talk is presented and numerically evaluated for typical examples. Author (GRA)

N71-23905# London Univ. (England). Dept. of Theoretical Physics.

CALCULATION OF PHYSICAL PROPERTIES OF COOPERATIVE ASSEMBLIES Final Technical Report

C. Dome Aug. 1970 265 p refs

(Contract DAJA37-69-C-1154)

(AD-718077; ARDG(E)-E-1247) Avail: NTIS CSCL 20/3

Much of the work this year has been concerned with the detailed exploration of the critical region for different models. The form of the function h(x) in the scaling-law equation of state for the two and three dimensional Ising models was calculated. The results of the calculation have been compared with experiment and with empirical formulae. It was found possible to account theoretically for the spurious unphysical singularities in the low temperature series for the Ising model which mask the true critical behaviour. Low temperature series for the spin 1 Ising model have been derived. The numerical results are consistent with the hypothesis that the indices beta and delta are spin-independent. For the problem of nonclose packed dimers on a lattice, series expansions have been derived as in the Ising problem and they have been used to establish the behaviour of monomer-dimer equilibrium. Detailed research has been undertaken into the Greens function for random walks on the bcc lattice. A number of exact formulae have been derived using generalized hypergeometric functions which could be of use in several branches of solid state physics. Finally, a careful analysis of the form of correction terms to critical behaviour in the Ising model has been carried out. This enables a precise definition of the critical region to be made. Author (GRA)

N71-23940# Naval Research Lab., Washington, D.C.

SELF AND MUTUAL ACOUSTIC RADIATION IMPEDANCES FOR PISTONS IN A PLANE INFINITE RIGID BAFFLE

R. L. Berkowtz and R. V. Baier 18 Jan. 1971 63 p refs

(AD-718313; NRL-7008) Avail: NTIS CSCL 20/1

Formulas to calculate the self-impedance and mutual-impedance coefficients of acoustic radiation from disks in an infinite rigid baffle are discussed. A Fortran IV computer program which evaluates these expressions is listed, and two tables of numerical values are printed. The first table lists both the self-impedance and the mutual-impedance coefficients as a function of ka and kd, where kd nka, N 2, 3, 4, ... 151, and where ka 0.02 0.02 0.1 0.5(0.5) 1.00, 1.20 (0.20) 3.00. The second table lists only the self impedance for ka = 2.50 (0.50) 77.0. Author (GRA)

N71-23961# Royal Aircraft Establishment, Farnborough (England).

THE PRODUCTION OF SOUND BY AMPLIFIED DISTURBANCES IN FREE SHEAR LAYERS [SCHALLERZEUGUNG DURCH ANGEFACHTE STOERUNGEN IN FREIEN SCHERSCHICHTEN]

A. Michalke Dec. 1970 42 p refs Transl. into ENGLISH of Deutsche Luft- und Raumfahrt Report FB-69-90

(RAE-Lib-Tran-1517) Avail: NTIS

A plane acoustic model for sound generation in a disturbed free shear layer was used, the flow field of which can be calculated by means of the linearized stability theory. A solution of the linearized Lighthill equation was derived assuming that the existence region of a Fourier component of the disturbances is finite in basic flow direction. It is found that the acoustic sources are due to the pressure fluctuations in the flow and the oscillation of the shear layer, both having different Mach number dependence. The solution is evaluated for the special case of a vortex sheet. The directivity of sound radiation far from the source region is calculated for various Mach numbers and temperature ratios. Author

N71-23974# Aerospace Corp., El Segundo, Calif. Engineering Science Operations.

APPLICATION OF FOURIER TECHNIQUES TO IMAGE EVALUATION

William E. Stoelzner 15 Oct. 1970 66 p refs

(Contract F04701-70-C-0059)

(AD-718095; TR-0059(8311)-2; SAMSO-TR-71-20) Avail: NTIS CSCL 20/6

The report is one of a series published to document the computerized image-evaluation program called POLYPAGOS. The results of diffraction theory and transfer function theory for an imaging system are summarized, and two algorithms for numerical integration of Fourier integrals are compared. The selection of the grid interval, based on the sampling theorem, is discussed; formulae are given for estimating proper grid size. The report includes tables giving the POLYPAGOS user an idea of the computational accuracy of the OTF value. Author (GRA)

N71-23976* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

MEASUREMENT OF TIME DIFFERENCES BETWEEN LUMINOUS EVENTS Patent

Goetz K. Oertel and Michael D. Williams, inventors (to NASA) Issued 9 Jul. 1968 (Filed 13 Apr. 1966) 4 p Cl. 346-107

(NASA-Case-XLA-01987; US-Patent-3,392,403; US-Patent-Appl-SN-542713) Avail: US Patent Office CSCL 20F

A mechanism for measuring nanosecond time differences between luminous events utilizing a streak camera is described. Light pipes transmit the light from the events to the streak camera and display them in a linear array for photographing. The events are photographed by the streak camera and the events appearing in the form of streaks on the film are compared to determine the time differences of the events.
Official Gazette of the U.S. Patent Office

N71-24005 California Univ., Los Angeles.
WAVEFRONT RECONSTRUCTION AND ITS APPLICATION TO THE STUDY OF THE OPTICAL PROPERTIES OF ATMOSPHERIC AEROSOLS
George Charles Sherman (Ph.D. Thesis) 1969 123 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 70-8208

Holographic techniques are discussed that permit, without disturbing the aerosol, the measurement of all the properties of aerosol particles that are important in atmospheric optics: size, shape, orientation, and internal structure of complex index of refraction. A technique is developed that provides for the first time in the capability for measurement of the scattering matrices of individual particles suspended in an aerosol. Dissert. Abstr.

N71-24056*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ADIABATIC INVARIANCE: THE EVOLUTION OF A CONCEPT
David P. Stern Apr. 1971 25 p refs
(NASA-TM-X-65498; X-641-71-137) Avail: NTIS CSCL 20K

The developmental history of the adiabatic invariance concept is outlined. Transfer of radiation energy is discussed including contributions by Rayleigh, Jeans, Ehrenfest, Bohr, Sommerfeld, Schrodinger, Alfven, and Rosenbluth. The evolution of celestial mechanics is also traced including contributions by Newton, Hamilton and Jacobi. J.M.

N71-24154 Utah State Univ., Logan.
THE EFFECTS OF ULTRASONIC VIBRATIONS ON THE COOLDOWN TIME OF BODIES IN LIQUID NITROGEN AND LIQUID HELIUM
David Griffiths Loosle (Ph.D. Thesis) 1970 158 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 70-10923

The quantitative effects of ultrasonic vibrations on the cooldown rate of bodies, initially at room temperature, immersed in cryogenic fluids were investigated by determining the influence of the following parameters: frequency of vibration (16 kilohertz to 60 kilohertz), acoustical intensity, Biot number, the depth of submergence of the specimen in the liquid, location of the specimen with respect to the transducer, and the volume to surface area ratio of the specimen. An intensive investigation employing liquid nitrogen showed that there was a critical sound pressure level below which there was no effect on the heat transfer rate and above which there was a linear reduction in the cooldown time until approximately a 50 percent reduction from the normal cooldown time was achieved. Plots showing the effects of the various parameters on the percent reduction are given and prediction equations for the percent reduction and the critical sound pressure level as a function of the pertinent variables were derived. Dissert. Abstr.

N71-24155# Aeronautical Research Labs., Melbourne (Australia).
ACOUSTIC RADIATION FROM A SPHERICAL ELASTIC SHELL
A. E. Billington Aug. 1970 9 p
(ARL/SM-352) Avail: NTIS

An approximation is made which allows the radial displacement of the adjacent stratum of fluid particles to propagate as a spherical wave function. In consequence the motion of the fluid and the motion of the shell may readily be incorporated in the one dynamical system. The mode of propagation of the displacement is then derived from Kirchhoff's integral representation of Huygen's principle. Author

N71-24006# Oak Ridge National Lab., Tenn.
FORTRAN PROGRAM FOR COMPUTING TWO DIMENSIONAL MAGNETIC FIELDS
S. S. Stevens Jan. 1971 9 p Sponsored by AEC
(ORNL-TM-2484) Avail: NTIS

A Fortran program was written to compute two dimensional magnetic fields. The program, called MAGMAP, considers straight current filaments perpendicular to a plane, and computes field components in the plane. Free space permeability is assumed throughout the region of interest. Author

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N71-23154# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
NEUTRON RADIOGRAPHY WITH Cf 252: A PORTABLE CAMERA
J. L. Cason [1970] 10 p refs Sponsored by AEC
(BNWL-SA-3169) Avail: NTIS

Battelle-Northwest is conducting a research program to determine the usefulness of Cf-252 as a source for portable thermal neutron radiography. Emphasis has been on developing a device using Cf-252 that could be used for laboratory, hot cell, or field radiography. The use of Cf-252 for neutron radiography in a portable device has been evaluated both analytically and experimentally. A 288 microgram Cf-252 source was used for experimental testing. This source has a neutron yield of 6.4×10 to the 8th power neutrons/sec. A first generation portable device which completely contains the Cf-252 has been designed and built and is presently being evaluated. Preliminary work included flux measurements and neutron radiographs. Author (NSA)

N71-23155# California Univ., Berkeley. Lawrence Radiation Lab.
ENERGY SPECTRA OF BACKSCATTERED ELECTRONS AND POSITRONS BY MONTE CARLO CALCULATIONS
Klaus-Dieter Tillmann 5 Mar. 1970 36 p refs
(Contract W-7405-eng-48)
(UCRL-19719) Avail: NTIS

The energy spectra and angular distribution of backscattered electrons and positrons from thick targets of Li, Be, Al, Fe, Cu, and Sn for 1.0-MeV particles and from Be and Sn targets for 0.5- and 2.0-MeV particles normally incident on the targets are presented. These spectra were calculated by a random-sampling Monte Carlo program on a CDC 6600 digital computer. Back-scattering coefficients are found to fit a dependence for $Z > 13$. The shapes of the energy spectra depend strongly on the atomic number Z and are found to be in good agreement with experimental data. Author (NSA)

N71-23156# Stanford Univ., Calif. Dept. of Mechanical Engineering.
STUDY OF RADIATION INDUCED NUCLEATION OF BUBBLES IN SUPERHEATED WATER Progress Report
H. T. Whitehouse, R. N. Christensen, D. A. Pilati, and T. J. Connolly 18 Dec. 1970 38 p refs
(Contract AT(04-3)-326)
(SU-326-P-13-5) Avail: NTIS

Whereas the previous fission fragment measurements required operation of the bubble chamber at pressures up to 500 psi and temperatures to 440 F, the alpha particle measurements require pressures to 1100 psi and temperatures up to 550 F. These more severe conditions required substantial changes in the system design and some of the system components. Initial experiments to observe bubble nucleation by alpha particles were unsuccessful due to large numbers of background bubbles. The experimental procedure was extended during the period to include high-speed (1000 frames per second) photography of the bubble chamber. The resulting motion pictures led to a more complete understanding of the occurrences during bubble nucleation and growth than had been possible by the previous technique of one still photograph per run. Author (NSA)

N71-23235# Nebraska Univ., Lincoln. Behlen Lab. of Physics.
UNIFIED TRACK THEORY
Robert Katz [1970] 29 p refs Presented at the 7th Intern. Conf. on Corpuscular Phot. and Visual Solid Detectors, Barcelona, 7–11 Jul. 1970
(Contract AT(11-1)-1671)
(COO-1671-28; CONF-700705-1) Avail: NTIS

A theory for particle track formation in emulsion and other physical and biological media is discussed. It is attempted to couple the dose-response function of a medium to gamma rays with the spatial distribution of dose from secondary electrons to yield the spatial distribution of response about the path of a charged particle. Measured and calculated data are presented for particle track formation in emulsion etchable track formation in dielectrics, the response of scintillation counters to heavy ions, and the inactivation of dry enzymes and viruses and cells by heavy ions. NSA

N71-23257 California Univ., Los Angeles.
THE OPTICAL AND MAGNETIC PROPERTIES OF NpO2(+2) DOPED IN Cs2UO2Cl4 AND IN CsUO2(NO3)3
Alfred Fai-Ming Leung (Ph.D. Thesis) 1969 126 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 70-8246

The absorption spectra of NpO2(+2) doped in Cs2UO2Cl4 and in CsUO2(NO3)3 were observed, and the excited electronic energy levels were identified through their vibronic patterns and magnetic properties. The spectra of both samples are entirely different due to the difference in the crystal structure. The EPR spectra of NpO2(+2) doped in Cs2UO2Cl4 and in CsUO2(NO3)3 were observed at liquid helium temperature. The Np(+6) in its host crystal was assumed to have an axial symmetry due to the strong NpO2(+2) complex. The resonances were identified and fitted to the axial spin Hamiltonian. Dissert. Abstr.

N71-23264*# Techtran Corp., Glen Burnie, Md.
EXCITATION OF SODIUM IN CERTAIN REACTIONS BEHIND SHOCK WAVES [VOZBUZHDENIYE NATRIIA V NEKOTORYKH REAKTSIIAKH ZA UDARNYMI VOLNAMI]
I. S. Zaslonko et al Washington NASA Apr. 1971 17 p refs Transl. into ENGLISH from Fiz. Goreniya Vzryva (Novosibirsk), v. 6, Jun. 1970 p 195–205
(Contract NASw-2037)
(NASA-TT-F-13622) Avail: NTIS CSCL 20H

Experiments directed toward finding the origin of nonequilibrium excitation in sodium atoms, hydroxyl radicals, or water molecules, which is observed after shock waves are described. Considerable attention is paid to the instruments used. It was found that nonequilibrium excitation occurred behind hydrogen-oxygen shock waves, or acetylene-oxygen, but not behind methand-oxygen or hydrogen-chlorine. It is concluded that the sodium electrinic excitation is a result of energy transfer from vibrationally excited OH or H2O molecules. Possible explanations for the failure of the methane-oxygen and hydrogen-chlorine systems to cause such excitation are also discussed. Author

N71-23286*# Wisconsin Univ., Madison. Theoretical Chemistry Inst.
THE SOLUTION OF THE DELTA FUNCTION MODEL FOR HELIUM-LIKE IONS
Carey M. Rosenthal 18 Mar. 1971 34 p refs
(Grants NGL-50-002-001; NSF GP-12832)
(NASA-CR-117895; WIS-TCI-434) Avail: NTIS CSCL 20H

A one dimensional Fredholm integral equation is derived for the ground state solution of the delta function model for electron Helium-like ions. This equation is solved numerically; the perturbation series is developed through E(20) and compared with the solution of the integral equation. The series is further analyzed in terms of the singularity which determines its radius of convergence. Author

N71-23287*# Wisconsin Univ., Madison. Theoretical Chemical Inst.
THE SPONTANEOUS IONIZATION OF A HYDROGEN ATOM IN AN ELECTRIC FIELD, 1
Joseph O. Hirschfelder and Larry A. Curtiss 31 Mar. 1971 37 p refs
(Grant NGL-50-002-001)
(NASA-CR-117894; WIS-TCI-435) Avail: NTIS CSCL 20H

The time independent Schrodinger equation expressed in parabolic coordinates for a hydrogen atom in an electric field was numerically integrated for the state n=5, n sub 1=3, n sub 2=0, and m=1 to obtain the resonance energy E sub r and the rate of ionization tau for field intensities ranging from 8 times 10 to the 5 power to 11 times 10 to the 5th power volts/cm. It is found that near the resonance energy, tau(−1) varies quadratically with (E-E sub r)2 in accordance with the well known Weisskopf-Wigner treatment of metastable states. When E is nearly equal to E sub r, the wave function has a node at the outer turning point - no explanation is offered. At the very high field intensities considered, there was considerable difference between sub r and the energy calculated by Raleigh-Schrodinger perturbation theory. Author

N71-23288# Nihon Univ., Tokyo (Japan).
ATOMIC ENERGY RESEARCH INSTITUTE Annual Report, 1970
1970 56 p refs
(NUP-A-71-1) Avail: NTIS

Main research subjects are plasma physics, low temperature physics, theoretical low and high energy nuclear physics and the history of science. The report consists of abstracts of individual works with introductory surveys on each of the main subjects. Author

N71-23291# Johns Hopkins Univ., Baltimore, Md. Dept. of Physics.
SECOND CLASS CURRENTS IN NUCLEAR BETA-DECAY
C. W. Kim and T. Fulton 1971 26 p refs Sponsored in part by NSF
Avail: Issuing Activity

Expressions for the ratio of ft-values for mirror beta-decays are given in the treatment of nuclei as elementary particles with emphasis on the effects of second class currents. The results are compared with the corresponding ones in the usual impulse approximation treatment with off-mass-shell and meson-exchange corrections. Theoretical implications of the data of Wilkinson and Alburger are examined. Author

N71-23301# DuPont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.
SELF RADIATION DAMAGE IN Cm 244 OXIDE AND ALUMINATE

W. C. Mosley 15 Oct. 1970 21 p refs Presented at the Basic Sci. and Nucl. Div. Joint Fall Meeting of the Am. Ceram. Soc., Gatlinburg, Tenn., 3–6 Nov. 1970
(Contract AT(07-2)-1)
(DP-MS-70-44; CONF-701116-1) Avail: NTIS

Self-radiation from alpha-decay of Cm-244 causes lattice swelling, phase transformations, and metamict state formation in several curium compounds. In curium oxides, the percentage swelling at saturation decreases with decreasing symmetry; swelling bcc C-type Cm_2O_3 is about half that in fluorite CmO_2 (about 0.3); monoclinic Cm_2O_3 does not swell. the rate of structure loss of curium oxides decreases with increasing temperature of prior heatings. In curium aluminate, the metamict state is produced before swelling reaches saturation. Radiaton-induced transformation at room temperature produces metastable phases which normally exist at higher temperature, e.g., bcc C-type Cm_2O_3 transforms to hexagonal A-type Cm_2O_3, and rhombohedral $CmAlO_2$ becomes cubic. Author (NSA)

N71-23302*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CHARACTERISTICS AND CONSTANTS OF MOTION METHOD FOR COLLISIONAL KINETIC EQUATIONS
Ferdinand F. Cap Apr. 1971 8 p refs Submitted for publication
(NASA-TM-X-65493; X-640-71-123) Avail: NTIS CSCL 20H

Collisional kinetic equations and their characteristics are discussed. The constants of motion method is used to solve the equations in order to obtain exact nonlinear solutions. A Langevin term is included with the Lagrange characteristics of the Vlasov equation to account for collisional effects due to long-range forces. Hamiltonian canonical equations of motion are also utilized in the derivation of collisional kinematic equations. Transformations of the kinetic equations are outlined as well as constants of motion and the Chandrasekhar equation. J.M.

N71-23335*# South Carolina Univ., Columbia. Dept. of Chemistry.
INFRARED SPECTRA OF MOLECULES AND MATERIALS OF ASTROPHYSICAL INTEREST Quarterly Progress Report, 15 Sep. – 15 Dec. 1970
James R. Durig 15 Dec. 1970 46 p refs
(Grant NGR-41-002-003)
(NASA-CR-117900; QPR-14) Avail: NTIS CSCL 20H

The vibrational spectra of several molecules which may be present in the atmosphere of the Jovian planets are discussed. The data provide vibrational frequencies which can be used to: (1) determine the compositions of the cloud covers of several of the planets; (2) provide structural information under favorable circumstances; (3) provide necessary data from which accurate thermodynamic data can be calculated; (4) and furnish information as to the nature of the potential energy function of the molecules and forces acting within them. Author

N71-23373# Rockefeller Univ., New York. Dept. of Physics.
THE NATURE OF FUNDAMENTAL INTERACTIONS Final Report
Abraham Dais 5 Nov. 1970 8 p refs
(Grant AF-AFOSR-1629-69)
(AD-717912; AFOSR-70-2548TR) Avail: NTIS CSCL 20/8

Contents: Strong interactions; Electromagnetic interactions; Weak interactions; Current algebra; partial conservation of the axial vector current. GRA

N71-23396*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ELECTRON DETACHMENT OF H(−) BY e(−) COLLISION
F. H. M. Faisal and A. K. Bhatia Mar. 1971 13 p refs Submitted for publication
(NASA-TM-X-65491; X-641-71-119) Avail: NTIS CSCL 20H

Within the approximations, the primary detachment cross sections for two processes are calculated. A number of divergencies are shown among the theoretical calculations and experimental observations. A qualitative analysis of the semiclassical model applications to electron detachment is discussed. In calculated velocity distribution, the ejected electrons were found to concentrate at very low energy of ejection, implying that the amount of interference is likely to be small except at the very lowest energies. J.A.M.

N71-23397*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
IONIZATION OF MULTIELECTRON ATOMS BY FAST CHARGED PARTICLES
K. Omidvar, H. L. Kyle, and E. C. Sullivan Apr. 1971 62 p refs Submitted for publication
(NASA-TM-X-65502; X-641-71-145) Avail: NTIS CSCL 20H

Ionization of five inert gas atoms; five alkalides; atomic magnesium, zinc, carbon, nitrogen, and oxygen; and lithium ions by electron impact were considered, and the total atomic cross section due to single ionization from all shells was calculated. Differential cross sections for ionization of helium and neon by electron impact, differential cross section for ionization of helium by proton impact, and photoionization of lithium were calculated. The available experimental data are compared. Calculations based on the Born approximation and a central field approximation for the active atomic electron are presented. The active electron is described before ejection by a Coulomb function with an effective charge given by the Hartree-Fock calculation, and is described by a Coulomb function with a charge of unity after ejection. Author

N71-23485# Technische Hogeschool, Delft (Netherlands). Afdeling der Technische Natuurkunde.
ANGULAR CORRELATION STUDIES OF CONVERSION ELECTRONS FROM Gd-154, OF NUCLEAR ELECTRONS FROM V-48 AND OF BREMSSTRAHLUNG FROM UNPOLARIZED ELECTRONS
Edzard William Koopmann (Ph.D. Thesis) 1970 74 p refs
Avail: NTIS

The utilization of the measurement of angular distributions for investigation of internal conversion of gamma rays, isospin conservation of beta decay and parity conservation in electromagnetic interactions, is shown. In experiments electrons were measured with a sector-focusing magnetic beta-ray spectrometer and the polarization of gamma rays was observed with a variety of detectors. ESRO

N71-23605# Technische Hogeschool, Delft (Netherlands). Afdeling der Technische Natuurkunde.
LIGAND HYPERFINE INTERACTIONS IN OXYHALIDES OF PENTAVALENT CHROMIUM, MOLYBDENUM, AND TUNGSTEN
Johannes Trudo Cornelis van Kemenade (Ph.D. Thesis) 1970 136 p refs
Avail: NTIS

To check the feasibility of approximations made in calculations of the atomic orbital coefficients, the latter are related to data from the electron paramagnetic resonance (EPR) spectrum. Two interactions are important in this technique: the Zeeman effect, and the hyperfine structure, which is divided into the central atom hyperfine structure (CHFS) and the ligand hyperfine structure (LHFS). The relation LHFS/EPR is investigated for oxyhalides of transition metals. ESRO

N71-23709# Technische Hogeschool, Delft (Netherlands). Afdeling der Technische Natuurkunde.
NEUTRON SCATTERING STUDY OF THE DYNAMICS IN DENSE ARGON GAS

Cornelis Dirk Andriesse (Ph.D. Thesis) 1969 110 p refs
Avail: NTIS

Atomic dynamics in a simple dense gas is investigated. Atomic motions, which determine the macroscopic transport properties of such a system are studied by means of scattering experiments with slow neutrons. Because of the low density in the gas phase, argon highly enriched in Ar-36 was used, since the scattering cross-section is very large. The coherent scattering spectra reflect interference effects due to collective atomic motions rather than the motion of individual atoms. ESRO

N71-23846# Florida State Univ., Tallahassee.
SU(3) x SU(3) CHIRAL LAGRANGIAN MODEL FOR ANTIKAON NUCLEON INTERACTIONS
Mary Elizabeth Mogge Hogan (Ph.D. Thesis) Jun. 1970 131 p refs Sponsored by AEC
(TID-25639) Avail: NTIS

A chiral Lagrangian model of meson-baryon scattering is used to develop a theory of antikaon nucleon, Sigma pion and lambda pion interactions. The meson and baryon fields are assumed to transform as nonlinear realizations of SU(3) × SU(3). In addition to pseudoscalar meson and J-p = 1/2(+)baryon fields, vector meson, J-p = 1/2(−)baryon, J-p = 3/2(+)baryon and J-p = 3/2(−)baryon fields are introduced in order to describe one particle exchange contributions. The chiral symmetry is broken by Lagrangians bilinear in either the baryon or pseudoscalar fields. An extensive formalism is developed in order to obtain physical predictions from the model. The partial wave amplitudes obtained from the chiral Lagrangian model are unitarized by a K-matrix formalism. Total cross sections are calculated for the processes antikaon yields antinucleon, antikaon yields Sigma pion, antikaon lambda pion resonance, Sigma pion yields Sigma pion, lambda pion yields sigma pion, Antikaon, lambda pion, and Sigma pion. Author (NSA)

N71-23876# Massachusetts Inst. of Tech., Cambridge. Lab. for Nuclear Science.
[PHYSICS RESEARCH AND DEVELOPMENT AT MIT, 1969] Progress Report, 31 Dec. 1969
1970 309 p refs
(Contract AT(30-1)-2098)
(MIT-2098-643) Avail: NTIS

Physics research and developments during the calendar year of 1969 are summarized. Activities are outlined for the cosmic ray group, accelerator physics collaboration, linear accelerator group, high energy accelerator physics group, ONR generator group, radioactivity group, charged particle reaction group, and the theoretical group. Personnel and publications are listed. NSA

N71-23878# Brown Univ., Providence, R.I. Dept. of Physics.
ON THE CONSISTENCY OF HARD PION THEOREMS IN K SUB l3 DECAYS
Robert Olshansky and Kyungsik Kang [1970] 18 p refs Sponsored by AEC
(NYO-2262-TA-233) Avail: NTIS

The K sub l3 scalar form factor is studied by the hard pion method in the framework of a (3,3*) + (3*,3) symmetry breaking model using a modified pole dominance approximation. A set of consistency relations are found which provides a test of the reliability of the quadratic smoothness assumption as well as of the symmetry breaking model. In particular, it is found that the solution for the symmetry breaking parameters which fit the data is inconsistent with the quadratic smoothness assumption. In addition, the status of other theoretical models is briefly reviewed. Author (NSA)

N71-23879# Rockefeller Univ., New York.
HADRONIC HELICITY CONSERVATION AND INELASTIC LEPTON-NUCLEON REACTIONS
A. Pais [1970] 9 p refs
(Contract AT(30-1)-4204)
(NYO-4204-10) Avail: NTIS

Conservation of hadronic s-channel helicity in the diffractive region is considered. If applicable to inelastic lepton nucleon processes, such conservation has many implications which are illustrated for pion and 2 pion-production. Polarization information is not needed for first verification. Author (NSA)

N71-23880# Brookhaven National Lab., Upton, N.Y.
METHOD FOR DECREASING THE ENERGY SPREAD IN THE AGS BEAM
J. P. Blewett 25 Nov. 1970 5 p Sponsored by AEC
(BNL-15424) Avail: NTIS

The same procedure as is used in debunching linac beams can be used in synchrotrons to decrease the energy spread in the beam by a factor of about five. Author (NSA)

N71-23881# Australian National Univ., Canberra. Research School of Physical Sciences.
A STUDY OF RESONANCES IN THE Si-29(p, gamma)P-30 REACTION
G. U. Din and J. R. Davis [1970] 19 p refs
(ANU-P/517) Avail: NTIS

Gamma ray decay schemes of 14 resonances in the Si-29(p,gamma)P-30 reaction in the range 900–2200 keV have been obtained with high resolution Ge(Li) detectors. Consistent resonance decay schemes were derived, along with decay schemes of bound levels. Decays to bound levels at 3.84, 4.74, 4.94, 5.21, 5.51 and 5.70 MeV were observed in this reaction for the first time. New results were obtained for the decays of some of the bound levels. The reported level at 4.458 MeV was confirmed. The decay schemes of the 1110, 1684, 1850, 1975 and 2070 keV resonances indicate a predominance of T- = 0 levels, whereas the 2105 and 2115 keV resonances are probably the split analogue of a T = 1 level in Si-30. Author

N71-23882# Australian National Univ., Canberra. Research School of Physical Sciences.
MAGNETIC ANALYSIS OF THE REACTIONS Li-7(He-3,d)Be-8 AND Li-7(He-3,t)Be-7
C. J. Piluso, R. H. Spear, K. W. Carter, D. C. Kean, and F. C. Barker [1970] 23 p refs
Avail: NTIS

The reactions Li-7(He-3,d)Be-8 and Li-7(He-3,t)Be-7 have been studied at a bombarding energy of 15 MeV. Energy spectra of deuterons and tritons were measured at laboratory angles of 10 deg and 25 deg using a broad-range magnetic spectrograph. In the range of excitation energies from 0 to 18 MeV in Be-8, no evidence was found for the existence of previously unreported narrow states that are suggested by systematics and simple models. The measured position and width of the 2.9 MeV 2 sup + level of Be-8 are in good agreement with values obtained previously from the reaction Be-9(p,d)Be-8, suggesting that the broad 2 sup + states at higher excitation energies have little lp-lh character. The deuteron spectra in the neighbourhood of the 16.6 and 16.9 MeV levels of Be-8 show interference effects which agree well with shell model predictions. The width of the 4.55 MeV minus 7/2 level of Be-7 was found to be (175 + or − 7) keV. Author

N71-23883# Syracuse Univ., N.Y. Dept. of Physics.
VAN HOVE MODEL AND NON-LEPTONIC HYPERON DECAYS
D. N. Goswami, J. Schechter, and Y. Ueda Nov. 1970 23 p refs Sponsored by AEC
(SU-1206-238; NYO-3399-238) Avail: NTIS

A pole model for nonleptonic decays is constructed where exchanged particles of all spins are included. Summation over the

different spins is carried out by means of the Van Hove model, assuming that the Regge pole term is important. It is found that a number of trajectories do not contribute for a very simple, essentially kinematical reason. A discussion of some consequences of this approach is given. Author (NSA)

N71-23884# Northeastern Univ., Boston, Mass. Dept. of Physics.
A QUARK-PARTON MODEL FOR ELECTROMAGNETIC MASS DIFFERENCES OF THE HADRONS
H. Goldberg and Y. N. Srivastava Apr. 1971 8 p refs Sponsored in part by NSF
(NUB-2060) Avail: Issuing Activity

The Cottingham formula for electromagnetic mass differences reveals possible logarithmic divergences as a result of the observed scaling behavior of the inelastic form factors W sub 1 and nu W sub 2. A parton model of hadrons, in which the canonical quarks are present in an arbitrary sea of partons common to the members of an isomultiplet, is seen to eliminate this divergence for all the Delta I = 2 cases, and for none of the Delta I = 1 cases. Author

N71-23888# California Univ., Berkeley. Lawrence Radiation Lab.
TWO REGGEON EXCHANGE CONTRIBUTIONS TO HADRON SCATTERING AMPLITUDES AT HIGH ENERGY
Chris Quigg (Ph.D. Thesis) Oct. 1970 186 p refs
(Contract W-7405-eng-48)
(UCRL-20032) Avail: NTIS

Regge cuts are discussed from a phenomenological point of view. Some attempts to derive amplitudes with Regge cuts are reviewed, including those of Amati, Stanghellini, and Fubini, and of Gribov. A phenomenological amplitude for the Regge cut from two Reggeon exchange is written down in a form that manifestly satisfies s-u crossing. The amplitude is formulated in terms of s-channel helicity partial wave amplitudes, so the Reggeization of s-channel helicity amplitudes is discussed as a technical simplification. Implications of Regge cuts for various duality breaking schemes (and vice versa) are summarized. Author (NSA)

N71-23889# Syracuse Univ., N.Y. Dept. of Physics.
EXCHANGE DEGENERACY AND OSCILLATING TOTAL CROSS SECTIONS
R. R. Amann Nov. 1970 12 p refs Sponsored by AEC
(NYO-3399-237) Avail: NTIS

The hypothesis that the Pomeron consists, in part, of a pair of complex conjugate Regge poles is shown to allow exact exchange degenerate fits to the high energy total cross section data. A unique prediction of this hypothesis is that the ratio of real to imaginary parts for the amplitude for pion negative proton yields pion negative proton scattering should not rise uniformly; but rather rise to plateau, remain approximately constant from 20 to 60 GeV, then resume its rise. Author (NSA)

N71-23895# Ballistic Research Labs., Aberdeen Proving Ground, Md.
A MATHEMATICAL STUDY OF THE UNFOLDING PROBLEM
Walter O. Egerland Jan. 1971 26 p ref
(AD-718228; BRL-1525) Avail: NTIS CSCL 20/8

Basic Mathematical aspects of unfolding problems arising in experimental nuclear physics are discussed. Suggestions are made for determining the basis for evaluating existing and future unfolding techniques before adoption for individual problems. Author (GRA)

N71-23896# Alberta Univ., Edmonton. Nuclear Research Centre.
FURTHER CALCULATIONS OF PROTON INELASTIC POLARIZATIONS AND ASYMMETRIES USING A SPIN DEPENDENT INTERACTION OF THE FULL THOMAS FORM
J. S. Blair and H. Sherif Sep. 1970 9 p refs Presented at 3d Intern. Symp. on Polarization Phenomena in Nucl. Reactions, Madison, Wis., 1970 Sponsored by AEC
(RLO-1388-600; CONF-700811-5) Avail: NTIS

Calculations in which the spin dependent part of a collective interaction has the full Thomas form are extended to include new data. Calculated polarizations out to 45 deg are displayed for inelastic scattering of 155-MeV protons exciting the 2.62-MeV level of Pb-208. It is shown that, if the interaction Hamiltonian can be described in terms of collective coordinates only and if the inelastic amplitudes are computed in DWBA with only one multipolarity of angular-momentum transfer being predominant, then the inelastic relative cross sections, asymmetries, and polarizations from a nucleus with J = 0 are the same as those calculated for a hypothetical zero-spin nucleus with some optical and kinematic parameters. Calculated polarizations are given for inelastic scattering of 155-MeV protons from B-11. NSA

N71-23897# Rockefeller Univ., New York.
ASYMPTOTIC BEHAVIOR OF WEAK SPECTRAL FUNCTIONS AND HADRONIC DECAYS OF THE W BOSON
Ling-Fong Li and E. A. Paschos [1970] 24 p refs
(Contract AT(30-1)-4204)
(NYO-4204-7) Avail: NTIS

Models of current algebra are employed to study the asymptotic properties of the spectral functions of weak currents. Asymptotically it is found that they all approach constant values closely related to each other. As an application, the results are used to estimate the hadronic decay of the intermediate vector boson. The branching ratio of the W-decay into hadrons to the decay into leptons is of order unity provided the electron-positron annihilation total cross section is point like and predominantly isovector. Another contribution is a consequence of PCAC, which relates the decay rate of the W-boson into a soft pion plus any number of bosons to the decay into all bosons through a known constant independent of the W mass. Author (NSA)

N71-23898# Rockefeller Univ., New York.
REGGE MODEL FOR INELASTIC LEPTON-NUCLEON SCATTERING
Heinz Pagels [1970] 21 p refs
(Contract AT(30-1)-4204)
(NYO-4204-9) Avail: NTIS

Lepton nucleon scattering into hadrons is analyzed according to the simple Regge pole model. Assuming SU(3) for the factorized residues from a strong interaction analysis of tensor meson-baryon couplings, 0.26 plus or minus 0/05 is obtained and compared with 0.31 obtained from total photon nucleon photoproduction data. For the inelastic structure functions, assuming all Regge poles couple in the deep inelastic region, p = ν/q squared greater than 4 is found. In the analogous neutrino process from these assumptions p greater than 4 is established. Also it is concluded that if scaling behavior of the neutrino process occurs for minus q squared greater than 1(GeV) squared then these sum rules are saturated to 90% only for energies greater than 200 GeV for minus q squared greater than 1(GeV) squared. Author (NSA)

N71-23921# Argonne National Lab., Ill.
INVERSION OF DE HAAS-VAN ALPHEN DATA. 1: CLOSED SURFACES WITH INVERSION SYMMETRY
R. L. Aurbach, J. B. Ketterson, F. M. Mueller, and L. R. Windmiller Jul. 1970 311 p
(Contract W-31-109-eng-38)
(ANL-7659) Avail: NTIS

A collection of a series of mathematical techniques and detailed computer programs are presented which allow the inversion of de Haas - van Alphen data on closed Fermi surfaces that possess inversion symmetry and have a single-valued radius vector measured from that center. De Haas - van Alphen data include extremal

cross-sectional areas and cyclotron effective masses, whereas the techniques discussed allow the determination from such data of the Fermi radius and Fermi velocity. The programs have been applied to the platinum group near-noble metals and the arsenic group semimetals. Programs are presented, however, which are applicable to all ten of the point groups containing the inversion element. Also included are programs for the generation of Kubic harmonics as linear combinations of spherical harmonics. The coefficients for this expansion are tabulated to order 1 = 60. Author (NSA)

N71-23933*# Stanford Univ., Calif. Inst. for Plasma Research.
SMALL-PITCH-ANGLE SYNCHROTRON RADIATION
Richard I. Epstein Mar. 1971 28 p refs
(Grant NGL-05-020-272; Contract N00014-67-A-0112; N00014-67-A-0112-0062)
(NASA-CR-117902; SUIPR-405) Avail: NTIS CSCL 20H

Synchrotron radiation from electrons with very small pitch angles is described and the intensity and polarization of this radiation are derived. Author

N71-23935# California Univ., Los Angeles. Dept. of Physics.
RESONANT SCATTERING BY IMPURITIES IN METALS AND THE ANDERSON MODEL
N. Rivier and J. Zitkova 1971 33 p refs Sponsored in part by NSF Prepared in cooperation with Cavendish Lab., Cambridge, Engl.
(Contract N00014-69-A-0200-4006)
(AD-718903) Avail: NTIS CSCL 20/12

The Anderson Hamiltonian, written in a representation where the extra orbital is not orthogonal to the conduction states, is used to derive a general theory of the electronic structure of dilute alloys. The theory describes both simple impurities in the overcomplete or Wolff limit, and transition or rare-earth impurities where the scattering of the conduction electrons has a resonance. The extra-orbital of Anderson is shown to be identical to a bound state extracted from higher bands by the impurity potential, and overlapping the conduction band in energy. The resonant scattering of conduction electrons is described by a pseudopotential, which is singular in energy, in analogy to the theory of band structures of pure transition elements. The position and width of the resonance, as well as a direct scattering potential introduced by the nonorthogonality, are given in terms of Andersons parameters. The resonance is narrowed by the nonorthogonality and disappears in the overcomplete limit. Author (GRA)

N71-23936# Hejtmanek (H. J.), Vienna (Austria).
SPECTRAL PROPERTIES OF THE LINEAR BOLTZMANN OPERATOR Final Technical Report, Dec. 1969 – Mar. 1970
H. J. Hejtmanek Jun. 1970 46 p refs
(Contract DAJA37-70-C-0608)
(AD-718865; ARDG(E)-E-1290(3)) Avail: NTIS CSCL 20/8

The linear Boltzmann operator describing multiple scattering processes in electron and neutron transport theory is studied for a compact and convex system embedded into vacuum. The multiple time-dependent scattering process is completely described by the linear Boltzmann equation which is considered as an abstract Cauchy problem in time-dependent perturbation theory. The function space used is the Banach L sup 1. For two transport systems, multiple scattering in R sup 3 and diffusion in a compact reactor R = or < R sup 3, the spectrum and the resolvent set of the linear Boltzmann operator are given. The Hille-Yoshida condition for the existence of a unique solution, a semigroup of class (C sup o), is given. Author (GRA)

N71-23937# Scientific Translation Service, Ann Arbor, Mich.
ANISN SYSTEM. LGR/B PROGRAM: FOR UPDATING THE ANISN LIBRARY TAPES WITH PLOTTING OF CROSS SECTION CURVES
Gilles Brandicourt et al Nov. 1970 24 p refs Transl. into ENGLISH from the French Report Prepared for Oak Ridge Natl. Lab.
(ORNL-TR-2408; CEA-N-1335; Rept-2) Avail: NTIS

The program LGR/B is an updating of the LGR program, which served to constitute and modify a library tape used by the program ANISN. LGR/B makes it possible to plot the total and absorption cross sections of the same element and to compare the cross sections of two different elements on the same graph. The program is listed in FORTRAN 4, and several examples of its use are given. Typical running time is of the order of one minute on an IBM 360/91, and the program uses 350K of core. NSA

N71-23938# Pennsylvania Univ., Philadelphia. Dept. of Physics.
GROUND STATE CORRELATIONS AS VARIATIONAL PARAMETERS IN THE NUCLEAR MANY BODY PROBLEM
R. M. Dreizler, Abraham Klein, F. R. Krejs, and Gerard Dreiss (Northeastern Univ.) 14 Dec. 1970 40 p refs Sponsored by AEC
(NYO-2171-333) Avail: NTIS

It is shown that amplitudes which normally occur in the random phase approximation (RPA) can be considered as variational parameters in an approximate theory of the ground state, allowing arbitrary two-particle-two-hole excitations of a Hartree – Fock substrate. These amplitudes obey equations which differ in detail from the RPA, though the two sets are shown to coincide in the weak coupling limit. All the desirable mathematical and physical properties of the RPA have their counterpart in the new theory, but in addition correlations are guaranteed to be given correctly near the weak coupling limit. The method is applied to an exactly soluble model and some comparison with other approximation methods is made. Author (NSA)

N71-23939# California Univ., Berkeley. Lawrence Radiation Lab.
MODIFICATION OF THE BERKELEY HILAC
Robert M. Main Sep. 1970 24 p refs Presented at Proton Linear Accelerator Conf., Batavia, Ill.
(Contract W-7405-eng-48)
(UCRL-19919; CONF-700929-4) Avail: NTIS

A program is presently in progress for the modification of the Hilac to make possible the acceleration of ions of all masses to a maximum energy of 8.5 MeV/n. The improved accelerator will consist of a pressurized 2.5 MV Cockcroft – Walton, injecting ions of minimum charge-to-mass ratio at 0.112 MeV/n into an Alvarez linac. The linac will be separated at 1.2 MeV/n where particles will be stripped to a minimum. The second linac section will be partitioned into individual cavities of approximately equal velocity increments. Adjustment of RF phase and gradient in these cavities will provide variable energy from 2.6 to 8.5 MeV/n. All cavities will operate at 70.2 MHz and magnetic quadrupole focusing will be used throughout. Author (NSA)

N71-23941# Addis Translations International, Woodside, Calif.
ELECTRON BEAM SHAPING IN A LINEAR INDUCTION ACCELERATOR
I. M. Matora et al Oct. 1970 14 p refs Transl. into ENGLISH from the Russian report In ENGLISH and RUSSIAN Prepared for Calif. Univ., Berkeley. Lawrence Radiation Lab.
(UCRL-Trans-1425; JINR-P9-5368) Avail: NTIS

Results of a study of beam losses in linear induction accelerators are briefly discussed. The study was undertaken for the development of the 30 MeV, 250-A LIU-30 electron linear induction accelerator, with a pulse recurrent frequency of 50 Hz and a mean beam power of 200 kW. NSA

N71-23942# California Univ., Berkeley. Lawrence Radiation Lab.
NUCLEAR RELAXATION IN NICKEL ALLOYS

Boris Chornik (Ph.D. Thesis) Dec. 1970 90 p refs
(Contract W-7405-eng-48)
(UCRL-20376) Avail: NTIS

Nuclear spin-lattice relaxation of Ni-63 and Pd-165 was measured at liquid helium temperatures in Ni metal and in a Ni-Pd 2 at.% alloy. An external magnetic field of 6 kG was applied to saturate the sample, eliminating the domain walls, so that relaxation through domain wall motion was not present. The relaxation times at 4.2 K were 0.05 sec for Ni-61 and 0.58 for Pd-165. The Ni relaxation time agrees well with a theoretical model based on interactions of the nuclear moments with orbital fluctuations of d-electrons. This model was used to derive a density of states at the Fermi level of 4-d electrons on the Pd impurity. Its value is 1.1 × 10 to the 12th power states. From this value an estimation of themagnetic localized at the Pd atom is 0.21 upsilon sub B. From the bulk magnetization data it was concluded that the Ni neighbors nearest to the Pd impurity have an extra moment of 0.025 upsilon sub B. Author

N71-23960# California Univ., Livermore. Lawrence Radiation Lab.
ON THE DYNAMICS OF CHARGED BUNCH COLLISIONS IN CONNECTION WITH THE IMPACT MECHANISM OF ACCELERATION
A. G. Bonch-Osmolovskii Jun. 1970 17 p refs Transl. into ENGLISH of Russian report JINR-P9-5179 Sponsored by AEC
(UCRL-Trans-1421) Avail: NTIS

A detailed analysis of the impact mechanism of acceleration of a bunch of charged particles by the coherent method is presented. The dynamics of the collision of charged bunches and the chief characteristics of impact acceleration are studied. The kinematics of elastic collision of two bunches (electron ring and ion bunch), and the joint acceleration of ions and electrons by impact acceleration are discussed. NSA

N71-23973# Minnesota Univ., Minneapolis. School of Physics.
STUDY OF N + alpha SYSTEM WITH THE RESONATING GROUP METHOD
I. Reichstein and Y. C. Tang [1971] 41 p refs Sponsored by AEC
(COO-1764-105) Avail: NTIS

The n + alpha and p + alpha systems are considered with the resonating group method in the one-channel approximation. The nucleon–nucleon potential used has both a central part and a spin-orbit component. From the results it is found that very good agreement with experiment can be obtained in the energy region below the reaction thresholds. In fact, even above the reaction thresholds where the one-channel approximation is expected to be less valid, the results are quite satisfactory. An effective potential between the clusters is also constructed. From this potential it is determined that the requirement of antisymmetry for the total wave function is very important. In particular, it creates an odd–even feature, wherein the effective central and the effective one-body spin-orbit potentials in the odd-l states are appreciably different from those in the even-l states. Author (NSA)

N71-23988# Connecticut Univ., Storrs.
MEASUREMENT OF THE DIFFERENTIAL SCATTERING CROSS SECTION FOR LOW KeV ENERGY He ATOMS OFF He Final Report, 1 Apr. 1965-31 Dec. 1970
Edward Pollack 31 Dec. 1970 6 p refs
(Grant DA-ARO(D)-31-124-G1155; DA-ARO/D/-31-124-G865)
(AD-718795; AROD-5376-5-P) Avail: NTIS CSCL 7/4

The report briefly discusses a project which was concerned with collisions of both He(+) and He beams with rare gas and diatomic molecular targets in an energy range from several hundred to several thousand electron volts. Author (GRA)

N71-23989# California Univ., Livermore. Lawrence Radiation Lab.
FISSION GAS RELEASE CURVES: GROWTH AND DECAY FROM FISSION OF Pu-239 BY FISSION SPECTRUM NEUTRONS (SUPPLEMENT)
D. C. Barg 9 Oct. 1970 150 p
(UCRL-50656-Suppl) Avail: NTIS

This supplement extends the scope of the original report to include times of release of radioactive gases as follows: 2, 4, 12, and 24 hr following fissioning. Tables and curves are presented for fission gas isotopes for Kr-85 through Kr-88 and from Xe-133 through Xe-138, including growth and decay of the daughter products. Author (NSA)

N71-23990# Idaho Nuclear Corp., Idaho Falls.
GAMMA RAYS EMITTED BY THE FISSIONABLE NUCLIDES AND ASSOCIATED ISOTOPES
J. E. Cline Dec. 1970 47 p refs
(Contract AT(10-1)-1230)
(IN-1448) Avail: NTIS

Data on gamma-ray energies and intensities emitted by the nuclides present in nuclear fuel material are presented. These energies and intensities were measured using a high-resolution Ge(Li) spectrometer. Gamma-ray pulse-height spectra are given. Author (NSA)

N71-23994*# Oak Ridge National Lab., Tenn.
APPROXIMATE HIGH ENERGY ALPHA-PARTICLE NUCLEUS COLLISION MODEL
T. A. Gabriel, R. T. Santoro, and R. G. Alsmiller, Jr. 1 Oct. 1970 29 p refs Submitted for publication Sponsored in part by AEC
(NASA Order H-38280-A)
(NASA-CR-118026; ORNL-TM-3153) Avail: NTIS CSCL 20H

An alpha-particle-nucleus collision model, which assumes that the nucleons within the alpha particle can be treated separately and independently except for their relative spatial locations when they enter the nucleus, is described. Because of the assumptions that are made, calculations based on the model can be carried out using the internuclear-cascade code of Bertini. Calculated data on the energy and angular distribution of emergent nucleons and on the cross sections for the production of various residual nuclei from alpha-particle nucleus collisions are found to be in very approximate agreement with existing experimental data. Author (NSA)

N71-23995 Northwestern Univ., Evanston, Ill.
A STUDY OF THE THRESHOLD ZEROS IN THE SOLUTIONS OF THE PARTIAL WAVE DISPERSION RELATIONS
Edward Bruce Nemanic (Ph.D. Thesis) 1969 92 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 70-6509

Single particle exchange is examined as an approximate force term in the partial wave dispersion relations (i.e., the resonance approximation) as well as the physical meaning of the methods ordinarily used to ensure proper behavior at threshold. An approximation scheme is proposed which simultaneously generalizes the resonance approximation and ensures correct threshold behavior. When applied to the case of Yukawa potential scattering, the method yields excellent results. The ideas, approximations and methods used in applying the partial wave dispersion relations are reviewed. The Mandelstam representation and unitarity are used from which the partial wave dispersion relations are derived in the form of a nonlinear integral equation. Two methods are discussed which are commonly employed to force the presence of the expected zeros. Dissert. Abstr.

N71-23996# Brookhaven National Lab., Upton, N.Y.
THE 1000 GeV STORAGE RINGS
J. P. Blewett 11 Nov. 1970 9 p refs Sponsored by AEC
(BNL-15423) Avail: NTIS

Problems of injection at 30 GeV into intersecting storage rings are considered. A procedure is presented for acceleration in the storage rings to 1000 GeV. Questions of energy loss by synchrotron radiation and of space-charge limits are given preliminary treatment. It is shown that it is possible with feasible components to provide colliding beams of several amperes at 1000 GeV having energy spread lower by a large factor than the energy spread expected in the beams in the CERN intersecting storage rings. Author (NSA)

N71-23997# Brookhaven National Lab., Upton, N.Y.
TWO LOOP APPROXIMATIONS TO PROPAGATORS IN THE SIGMA MODEL
T. F. Wong and G. S. Guralnik (Imp. Coll. of Sci. and Technol.) Dec. 1970 30 p refs Sponsored by AEC
(NYO-2262-TA-219) Avail: NTIS

A simple and systematic procedure is established for directly generating perturbation theory for the sigma model order by order in the number of loops rather than in powers of the bare coupling constant. This self consistent Greens function method is demonstrated by deriving the already known tree and one loop approximations and then is applied to the much more complex problem of the two loop approximations to the propagators. The explicit form is displayed for these and it is demonstrated that in the limit of no symmetry breaking and zero pion bare mass the renormalized pion mass remains at zero as is required by the Goldstone theorem. These are the essential first steps toward calculating a unitary pion – pion scattering amplitude with this model to the two loop order. Author (NSA)

N71-23998# Washington Univ., Seattle. Dept. of Physics.
TROUBLES WITH STRICT CONFORMAL SYMMETRY
David G. Boulware, Lowell S. Brown, and R. D. Peccei 1970 21 p refs
(Contract AT(45-1)-1388)
(RLO-1388-598) Avail: NTIS

Formal low-energy theorems for matrix elements involving the stress tensor can be used to derive the differential equations that express scale and conformal invariance. It is shown that these equations, when applied to a single particle matrix element of two fields, yield an integral representation that violates causality save for the trivial case where it reduces to the tree graphs of a free field. Although it is possible to construct conformally invariant, fully off-mass-shell amplitudes whose restriction to the mass shell yields a nontrivial result, these on-mass-shell amplitudes are not invariant under conformal transformations. This altered behavior can be traced to an implicit assumption of analyticality when the stress tensor carries off small momenta that is, in general, false. Author (NSA)

N71-23999*# National Aeronautics and Space Administration. Washington, D.C.
CLASSICAL PATH BROADENING FUNCTIONS FOR A DEBYE SHIELDED INTERACTION
J. Cooper (Joint Inst. for Lab. Astrophys.), S. Klarsfield (Div. De Physique Theorique, Orsay, France) Boulder, Colo. Joint Inst. for Lab. Astrophys. 17 Mar. 1971 48 p Supported in part by ARPA
(Contract DA-31-124-ARO(D)-139)
(NASA-TM-X-67149; JILA-107) Avail: NTIS CSCL 20H

Stark broadening calculations of isolated neutral atom lines in the classical path approximation are presented which involve an electron (moving along a straight line path) interacting directly with the atom. Correlations between the electrons are taken into account by imposing a cutoff in the interaction, when the distance from the atom exceeds the Debye length. A more consistent procedure for the correlation effects is given to replace the direct interaction of the electron by a Debye-shielded interaction. The function A, B, a and b which are required in the theory when the Debye-shielded interaction is used are considered in detail. When the distance from the atom over the Debye length is less than 0.1, it is found that the a and b functions may be closely reproduced by using unshielded functions in conjunction with an upper cutoff of 0.68 Debye length. A computer program to generate these functions is appended. Author

N71-24017 National Lending Library for Science and Technology, Boston Spa (England).
STRUCTURE OF GAS DISCHARGE IN THE PROPORTIONAL AND GEIGER RANGES WHEN USED IN CHARPAK CHAMBERS
H. J. Stuckenberg 19 Jan. 1971 17 p Transl. into ENGLISH from German publication
(NLL-M-20172-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The discharge processes in the multiwire proportional counters, used for localizing energetic charged particles, are described. Mathematical expressions are developed for the proportional counter tubes, and for discharges in the Geiger range in self-quenching and non-self-quenching gases. N.E.N.

N71-24049 Michigan State Univ., East Lansing.
CHIRAL DYNAMICS CALCULATIONS OF SINGLE PION PRODUCTION IN PION NUCLEON INELASTIC SCATTERING
William Frederick Long (Ph.D. Thesis) 1969 151 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 70-9589

The calculation was done for five different charge channels retaining all Feynman diagrams and computing the integrals necessary to obtain total and differential cross sections by means of a Monte Carlo method to within four per cent. The results indicate that the best fit to low energy total cross sections was given by a model in which chiral symmetry was broken by a term which transforms as a rank two chiral tensor. For incident pion energies much greater than 300 MeV none of the chiral dynamics models employed fit the total cross sections well. Dissert. Abstr.

N71-24050 Cincinnati Univ., Ohio.
ON THE APPLICATION OF FADDEEV EQUATIONS AND THE COULOMB T-MATRIX TO ELECTRON CAPTURE IN HYDROGEN
Chester P. Carpenter (Ph.D. Thesis) 1969 129 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 70-9001

The application of Faddeev's equations together with the Coulomb two body T-matrix to a three body rearrangement collision problem in which electrons are captured by fast protons in passing through atomic hydrogen is discussed. Contributions to the scattering amplitude arising from both the continuum and bound states are calculated. In the high energy limit the contribution from the bound states is summed. The dependence of the contribution to the matrix element, arising from the bound states, on the velocity of the incoming protons decreases much faster than does the contribution arising from the continuum states. The contribution to the matrix element arising from the continuum states differs by a phase factor. Dissert. Abstr.

N71-24079*# Techtran Corp., Glen Burnie, Md.
RAMAN EFFECT AND THE PROBLEM OF THE STRUCTURE OF THE CYANATE RESIDUE (CONTRIBUTION 30) ON THE NATURE OF THE PSEUDOHALOGENS [RAMAN-EFFEKT UND DAS KONSTITUTIONSPROBLEM DES CYANAT-RESTES (30. MITTEILUNG) ZUR KENNTNIS DER PSEUDOHALOGENE]
Josef Goubeau Washington NASA Apr. 1971 11 p refs Transl. into ENGLISH from Ber. Deut. Chem. Ges. (Heidelberg), v. 68, 1935 p 912–919
(Contract NASw-2037)
(NASA-TT-F-13636) Avail: NTIS CSCL 20H

The Raman effect was used to give fast and definite identification to the two isomeric structures of the cyanate residue. The two oscillation spectra obtained correspond to the straight arrangements −O − C ≡ N, and O = C = N. Various derivatives of cyanic acid were analyzed in the same manner and their structures determined. Author

N71-24096# Brookhaven National Lab., Upton, N.Y.
PRECOMPOUND DECAY FROM A TIME DEPENDENT POINT OF VIEW
G. D. Harp and J. M. Miller (Columbia Univ.) Dec. 1970 29 p refs
(CU-1019-79) Avail: NTIS

A model is proposed for following the progress of nucleon-induced nuclear reactions as a function of time. It predicts that the majority of protons and high-energy neutrons emitted from heavy targets in these reactions appear before internal statistical equilibrium has been established. For the 18-MeV (p,xn) reaction with Ta-181, however, the model predicts fewer high-energy neutrons than are observed experimentally. Further, there is a difference in shape between the predicted and observed spectrum. It is suggested that this model might best be used in conjunction with Monte Carlo cascade calculations of high energy nuclear reactions to follow the complete equilibration of the nonequilibrated excited nuclei left after these cascades are terminated. An example of using the model for this purpose is given. Author (NSA)

N71-24097 Florida State Univ., Tallahassee.
LOW ENERGY FISSION OF Th 232
Andrew John Tofe (Ph.D. Thesis) 1969 114 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 70-11169

A study of the mass and charge distribution of Th-232 with 11.3 MeV protons and 11.5 MeV deuterons was performed. Cumulative and independent yields were measured for rare earth fission product nuclides. Yields were also measured for iodine fission product nuclides, in the 11.5 MeV deuteron fission. Computerized analysis of Ge(Li) spectra was used to determine the nuclides from complex spectra of rare earth and iodine fission products. The Minimum Potential Energy (MPE), Equal Charge Displacement (ECD), and Unchanged Charge Distribution (UCD) postulates were tested with an experimentally measured neutron function. The MPE was found to best fit the 11.5 MeV deuteron data with a shell corrected mass equation. For the proton data it was not possible to make a definitive choice between the MPE and ECD postulates. Dissert. Abstr.

N71-24098 Florida State Univ., Tallahassee.
CHARGED PARTICLE FISSION OF U238
Abdel-Hakim Taha Kandil (Ph.D. Thesis) 1969 103 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 70-11131

A Ge(Li) spectrometer has been used to measure the cross-sections of some 20 nuclides formed in the 11.2 MeV proton and 10.6 MeV deuteron fission of U-238. Some of the measurements were carried out with rapid radiochemical separation of the lanthanide and yttrium nuclides, as a group. Part of the measurements have been conducted with gross fission gamma counting of the irradiated uranium target. From the estimated cross-sections mass yield curves for both the 11.2 MeV proton and 10.6 MeV deuteron fission of U-238 have been constructed. The net result of the research was that the most satisfactory description of low energy fission induced by charged particles is provided by the postulate of minimum potential energy although in some cases the equal charge displacement rule was equally good. Dissert. Abstr.

N71-24112# Colorado Univ., Boulder. Dept. of Physics and Astrophysics.
COMMENTS ON SHAPES OF ANGULAR DISTRIBUTIONS OF (He-3,t) AND (p,n) TRANSITIONS TO POSITIVE 0 ANTI-ANALOG STATES
E. Rost [1970] 9 p refs
(Contract AT(11-1)-535)
(COO-535-625) Avail: NTIS

This comment points out that the assumptions used by Noble are not valid for the reaction considered; hence, the anomaly in the angular distributions remains to be explained. Author (NSA)

N71-24139# Addis Translations International, Woodside, Calif.
AUTOMATING A 2 Ge V ELECTRON LINAC
I. A. Grishaev et al [1970] 12 p refs Transl. into ENGLISH from the Russian report Prepared for Stanford Linear Accelerator Center
(SLAC-TRANS-126; KHFTI-70-16) Avail: NTIS

Certain aspects of using an electronic digital computer for over-all automation of a 2-GeV electron linac are discussed. Data are given on existing and required beam stabilities. The basic automatic-control circuits and automation stages are analyzed. Author (NSA)

N71-24160# Aerospace Corp., El Segundo, Calif. Lab. Operations.
VIBRATIONAL ENERGY TRANSFER IN N2-CO AND N2-NO MIXTURES Technical Report, Jul. 1969 –Jun. 1970
Kenneth P. Horn and Peter E. Oettinger 15 Dec. 1970 36 p refs
(Contract F04701-70-C-0059)
(AD-718093; TR0059(6220-50)-4; SAMSO-TR-71-4) Avail: NTIS CSCL 7/4

Flow-tube experiments on vibrational energy transfer from N2 to CO and NO are described. A primary flow of N2 was vibrationally excited by an S-band microwave discharge and mixed with either cold CO or NO. The first overtone band radiation from the heteronuclear molecules was spectrally resolved at selected downstream stations, and the data were compared with an analytical model computed for different number density distributions. Number density distribution measurements do not agree with either the Boltzmann distribution or with the Treanor, et al., non-Boltzmann distribution for high vibrational levels. Author (GRA)

N71-24168# Oak Ridge National Lab., Tenn.
SYSTEMATIZATION OF THE INELASTIC INTERACTIONS OF HIGH-ENERGY PIONS AND NUCLEONS WITH ATOMIC NUCLEI
V. S. Barashenkov et al 1970 46 p refs Transl. into ENGLISH from Russian report
(ORNL-tr-2399) Avail: NTIS

A systematic study of the characteristics of inelastic nucleon and pion-meson reactions with nuclei is presented in the energy range in which calculations with the usual cascade model are valid. The emphasis is on the region with projectile energy greater than 0.4 GeV where the processes of pion-meson production are important. Comparison with previous results reveals that many secondary particle characteristics are quite dependent upon the details of the cascade model and, in particular, on the diffuseness of the nuclear boundary. NSA

N71-24210# Brookhaven National Lab., Upton, N.Y.
[PHYSICAL AND LIFE SCIENCES, ENGINEERING, AND SUPPORTING ACTIVITIES] Annual Report, 1 Jul. 1970
Oct. 1970 233 p refs
(Contract AT(30-2)-GEN-16)
(BNL-50230) Avail: NTIS

Development and operation of the alternating gradient synchrotron, beam research reactor, and medical reactor are reported.

Biological, chemical, engineering, and high-energy research projects are summarized as well as projects in computers, instruments, mathematics, medicine, nuclear and solid-state physics, metallurgy, and radiation chemistry. J.M.

N71-24211# Argonne National Lab., Ill.
ON THE MULTIPLE SCATTERING OF GAMMA RADIATION
P. J. Brockwell and H. Greenspan Jun. 1970 31 p refs
(Contract W-31-109-ENG-38)
(ANL-7689) Avail: NTIS

A method was devised to calculate the joint and marginal distribution of the emergent wavelength lambda and angle of emergence Theta, given a quantum of gamma radiation incident on the left face of the slab sequence set x: 0 < or = x < or = a with wavelength lambda sub zero and angle of incidence theta sub 0. The method has been applied in this instance to scattering cross sections as given by the Klein-Nishina formula, but can be used with any other specified scattering law. Results obtained compare well with Monte Carlo calculations for marginal distributions, but the developed procedure yields more information regarding joint distributions for the same effort. Author (NSA)

N71-24212# Northeastern Univ., Boston, Mass.
MEASUREMENTS OF THE A2(−) AND A2(+) MASS SPECTRA
D. Bowen, D. Earles, W. Faissler, D. Garelick, M. Gettner et al 6 Apr. 1971 16 p refs Submitted for publication Supported in part by AEC, Ford Found., and A. P. Sloan Found. Prepared in cooperation with State Univ. of N.Y., Stony Brook
(Grants NSF GP-9217; NSF GP-25307)
(NUB-2063) Avail: Issuing Activity

Observations of the mass distribution of the A2 meson produced in the reaction pion proton yields A2 proton are reported. The A2's were observed using a missing mass technique. Measurements were made with 5 and 7 GeV negative pion as well as 5 GeV positive pion beams. For each beam setting (5(−), 5(+), and 7(−) GeV), more than 17,000 A2's above background were observed with 0.2 < or = t absolute < or = 0.29 (GeV) sq. The A2 peaks are well described by a Breit-Wigner shape, whereas the dipole mass formula does not fit the data. Author

N71-24228 Washington Univ., St. Louis, Mo.
DELAYED NEUTRONS FROM He 3 AND He 4 INDUCED FISSION OF U 238, Th 232, AND Bi 209 AND FROM SPONTANEOUS FISSION OF Cf 252
Eugene Thomas Chulick (Ph.D. Thesis) 1969 191 p
Avail: Univ. Microfilms: HC $8.80/Microfilm $3.00 Order No. 70-10948

Experiments were run at bombarding energies of 20 to 29 MeV for He-4 and 22 to 34 MeV for He-3. Fission yields of Mo-99 were measured and used to monitor the beam intensities. Delayed neutron decay curves from the He-3 and He-4 fission of U-238 and Th-232 were resolved into seven half-life groups of 55, 24, 16, 5, 2, 0.5 and 0.2 sec. The three longest lived groups are attributed to Br-87, I-137, and Br-88, respectively. Data from the He-3 fission of Bi-209 were resolved into four half-life groups of 55, 16, 3.2 and 1.4 sec. These half lives are similar to the half lives of known bromine precursors. Four delayed neutron groups were found in the spontaneous fission of Cf-252 with half lives of 0.5 + or − 0.1, 2.0 + or − 0.3, 6.1 + or − 1.4, and 28.8 + or − 1.1 sec and relative abundances of 0.17 + or − 0.05, 0.30 + or − 0.03, 0.22 + or − 0.02, and 0.31 + or − 0.01 respectively. Dissert. Abstr.

N71-24236 Baylor Univ., Houston, Tex.
THREEBODY BOUND-STATE CALCULATIONS FOR SOME LIGHT NUCLEI
Charles Chi-Hei Leung (Ph.D. Thesis) 1969 133 p
Avail: Univ. Microfilms: HC $8.40/Microfilm $3.00 Order No. 70-7667

The approximate method of solving the three-body bound-state Schroedinger equation is generalized to a wave function method which preserves the hermiticity of the Fredholm kernel and permits an angular momentum analysis. This method is applied to the ground state calculation of three nuclei in chosen three-body models. The interactions are two-body nonlocal but separable potentials determined by fitting the two-body scattering data and binding energies. The wave functions obtained for the three-alpha system are applied to calculate the root mean square radius of the nucleus. The values found from the use of different model potentials are compatible with the experimental matter radius of C-12. Dissert. Abstr.

N71-24250# Rutgers Univ., New Brunswick, N.J. Dept. of Physics.
NUCLEAR SYMMETRY ENERGIES AND FERMI beta-DECAY RATES
Aram Z. Mekjian [1970] 57 p refs Supported in part by NSF
Avail: Issuing Activity

The sum of the squares of the Coulomb mixing matrix elements, the average or centroid energy in this mixing, and the splitting in the centroid energies of the different isospin components in the mixing are calculated. The splitting in the centroid energies of the Coulomb strength distribution is compared in magnitude and mass number dependence with the isospin splitting energy in the strength distribution of a single proton excitation of the nucleus. The corrections, arising from the isospin symmetry-breaking effects of the Coulomb force, to the superallowed Fermi beta decay rates are investigated. The results are compared with the predictions of the hydrodynamic and shell models. The near constancy of the ft values for these superallowed beta decay transitions is discussed. Author

N71-24251 Purdue Univ., Lafayette, Ind.
STUDIES IN MOLECULAR SPECTROSCOPY: INFRARED BAND CONTOURS OF PERPENDICULAR SYMMETRIC TOP MOLECULES
Bruce Howard Kleinstein (Ph.D. Thesis) 1969 370 p
Avail: Univ. Microfilms: HC $16.65/Microfilm $4.75 Order No. 70-8914

A computer program was written to examine the resolution of an infrared rotation-vibration band into its individual lines. The program was applied to light molecules. A program was also written to observe the effects of second order Coriolis coupling, centrifugal distortion, changes in moments of inertia, and molecular dipole moment with vibration. Dissert. Abstr.

N71-24252# State Univ. of New York, Stony Brook. Inst. for Theoretical Physics.
RESONANT ELASTIC SCATTERING OF PROTONS FROM ANALOGUE AND COMPOUND STATES
S. Fallieros (Brown Univ.) and G. E. Brown (Nordisk Inst. for Teoretisk Atomfysik) [1969] 28 p refs
(Contract AT(30-1)-4032)
(NYO-1082-29) Avail: NTIS

A general derivation of the amplitude for elastic scattering in the presence of one analog state and many compound (T-lower) states is given. The form of the amplitude is derived in a rather general scattering formalism by using unitarity and invariance under time reversal. The assumptions necessary to make the transmission coefficient vanish at some energy are stated. An additional assumption is necessary if it is to vanish at the unperturbed energy of the analog. Author (NSA)

N71-24283 Stanford Univ., Calif.
A THRESHOLD THEOREM FOR THE RADIUS OF THE F

SUB 2v NUCLEON FORM FACTOR AND THE EFFECT OF A DEGENERATE NEUTRINO SEA ON ELECTROMAGNETISM
Jeffrey Paul Royer (Ph.D. Thesis) 1969 80 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 70-1595

A method for expanding the absorptive part of the sidewise dispersion relation for the F2v radius is developed. First order terms are obtained in the limit of the pion mass going to zero. The expansion provides a method for attempting to estimate the corrections to the first order term coming from 2 pion-N and higher intermediate states. A limit on the Fermi energy was established by studying light propagation and the character of magnetic fields in a neutrino sea. Solutions to these equations show that the effect of the neutrino sea on electromagnetism is too small to observe. Dissert. Abstr.

N71-24254 Pittsburgh Univ., Pa.
CROSS SECTION FOR EXCITATION OF ATOMIC HYDROGEN TO THE METASTABLE 2 2 S1/2 STATE BY ELECTRON IMPACT: POLARIZATION OF LYMAN ALPHA RADIATION PRODUCED IN PROTON ATOM COLLISIONS
Walter Eric Kauppila (Ph.D. Thesis) 1969 189 p
Avail: Univ. Microfilms: HC $8.60/Microrilm $3.00 Order No. 70-8626

The cross section for excitation of atomic hydrogen to the S2S1/2 state by electron impact was measured in a modulated crossed beam experiment in the energy range extending from threshold to 1000 eV. Absolute values for the 2S cross section were obtained by measuring the ratio of the 2S to 2P cross sections and using previous measurements of the 2P cross section, which were normalized to the Born approximation at high energies. The measured cross section is found to be in agreement with the Born approximation above 200 eV. The polarization of Lyman alpha radiation produced in charge transfer collisions between protons and the inert gas atoms Ar, Ne, and He was measured for proton energies extending up to 24 keV. A Brewster's angle polarization analyzer was used to determine the polarization fractions. The measured polarizations were found to exhibit some structure as a function of energy and a correspondence was found between features of the measured polarization curves and previous measurements. Dissert. Abstr.

N71-24255 Princeton Univ., N.J.
TESTS FOR ISOTENSOR COUPLINGS IN ELECTROMAGNETIC INTERACTIONS
Ernest Eisenhardt Bergmann (Ph.D. Thesis) 1969 76 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 70-8347

The reaction first suggested by Dombey and Kabir to test for a possible isotensor coupling in the electromagnetic interaction, gamma + d yields N + N* (1236), is studied here in great detail to ascertain its usefulness as a precision test for such couplings. A general survey of other possible reactions to test for isotensor terms is included. Because of the importance of the reaction e(+) + e(-) 3 pi, a detailed analysis of this reaction is included in the appendix. Dissert. Abstr.

N71-24281 South Carolina Univ., Columbia.
ELECTRON ENERGY BANDS OF VANADIUM IN SEVERAL EXCHANGE POTENTIALS BY THE APE METHOD
Jay Sharon Bolemon (Ph.D. Thesis) 1969 193 p
Avail: Univ. Microfilms: HC $8.80/Microfilm $3.00 Order No. 70-9277

The electron energy bands for body-centered cubic vanadium have been calculated for several different electron exchange approximations, using the augmented-plane-wave method. The bands for vanadium were calculated at special points in the Brillouin zone for the full exchange and reduced exchanges of 80, 70, and 60 percent of this value. The reduction to 80 percent influenced the bands near the fermi surface to a sufficient extent so that the effect should be detected by experiment. Consequently, the bands were derived for the full and .8 cases at 1024 points in the Brillouin zone. In addition, results from atomic calculations are presented which suggest that a more natural way to include exchange is to keep different exchange potentials for central field wavefunctions of different l values. The bands were then approximated by reducing the exchange to the .8 value for l > or = 2 wavefunctions and retaining the full exchange for the s and p states. Dissert. Abstr.

N71-24286 Louisiana State Univ., Baton Rouge.
BAND-MIXING EFFECTS IN THE EVEN-EVEN DEFORMED NUCLEI Gd 154, Dy 160, AND Er 168
George Earl Keller (Ph.D. Thesis) 1969 211 p
Avail: Univ. Microfilms: HC $9.70/Microfilm $3.00 Order No. 70-9066

The gamma rays emitted in the decay of Eu-154, Dy-160, and Er-168 to excited states of Gd-154, Dy-160, and Er-168, respectively, were detected with Ge(Li) detectors and analyzed on a 4096 channel analyzer. The gamma ray energies and intensities were measured with very high precision. For the prominent gamma rays emitted by each nucleus, the energies were determined to within 10 to 40 keV and the relative intensities were determined to within 2 to 4%. The energies were measured relative to a set of precise energy standards. A careful and detailed photopeak efficiency calibration for the detectors enable the precise intensity measurements. The efficiency calibration resulted from a comparison with the well known properties of NaI detectors. The estimated uncertainty in the relative efficiency calibration was 5%. The analysis of the gamma-ray spectra was accomplished using a computer technique to fit a Gaussian function to each photopeak in the spectra. Dissert. Abstr.

N71-24287 University of Southern Calif., Los Angeles.
ELASTIC AND INELASTIC SCATTERING OF 28 MeV PROTONS FROM IRON, COBALT, NICKEL AND ZINC
Paul Spurgeon Lewis, Jr. (Ph.D. Thesis) 1969 140 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 70-8532

Differential cross sections for elastic scattering of 28.0 MeV protons from natural isotopic mixtures of Fe, Co, Ni and Zn were measured at thirty six scattering angles between 10.0 and 150.0 degrees. Cross sections for scattering from the first excited states of Fe, Ni and Zn and the integrated cross sections for scattering from all excited states with Q values down to -8.0 MeV were also measured. Good fits to the scattering data were obtained with the optical model. The parameters found were in general agreement with those found by Satchler at 30.3 MeV. However, the real potential depth required to fit the Ni data was approximately 1.3 MeV greater than predicted by Satchler's linear function of the nuclear asymmetry, and the variation of potential depths between elements was not well represented by a linear function. The best fits were obtained with parameter sets in which the imaginary potential had a larger radius and smaller peak width for Ni than for its neighbors. Dissert. Abstr.

N71-24301# Sandia Corp., Albuquerque, N.Mex.
RAMAN SCATTERING IN LIQUID LASING MATERIAL CONTAINING POCl3
M. J. Fitch Dec. 1970 14 p refs Sponsored by AEC (SC-RR-70-762) Avail: NTIS

Raman scattering of POCl3 and the lasing solution POCl3:ZrCl4:Nd(+3) is reported. Measurements of the absolute cross section of the four sharpest lines of pure POCl3 and relative cross sections of the corresponding modes in POCl3:ZrCl4:Nd(+3) are also reported. Author

N71-24302# Australian National Univ., Canberra. Research School of Physical Sciences.
A NOTE ON THE EXTRAPOLATION OF THE C 12 PLUS C 12 AND C 12 PLUS O 16 REACTION CROSS SECTIONS TO ASTROPHYSICAL ENERGIES
B. N. Nagorcka, G. D. Symons, W. M. Zuk, and J. R. Patterson (Adelaide Univ.) [1970] 5 p refs Sponsored in part by Queen Elizabeth II Fellowship Funds
(ANU-P/515) Avail: NTIS

A previous extrapolation of the C 12 + C 12 reaction cross section is re-evaluated in the light of new measurements of the C 12 + O 16 reactions which suggest that the quasi-molecular resonances observed in these reactions do not contribute to the cross sections at the lowest energies. Author

N71-24311# Nuclear Cross Sections Advisory Committee (AEC).
REPORTS TO THE AEC NUCLEAR CROSS SECTIONS ADVISORY COMMITTEE MEETING
R. E. Chrien, comp. May 1970 295 p refs Meeting held at Chicago, 20–22 May 1970
(NCSAC-31; EANDC(US)-143-U; INDC(US)-22-U; CONF-700537) Avail: NTIS

Preliminary data and informal statements of developments in measuring neutron and nuclear cross sections are presented. Subjects include: microscopic neutron cross sections relevant to reactor development, including shielding and inverse reactions; charge particle cross sections, as appropriate in developing and testing nuclear models; gamma-ray production, radioactive decay, and theoretical developments in nuclear structure; and proton and alpha-particle cross sections, at energies of up to 1 GeV, which are of interest to the space program. J.M.

N71-24329# Northeastern Univ., Boston, Mass. Dept. of Physics.
ARGAND DIAGRAM ANALYSES OF PION ETA-MESON YIELDS PION ETA-MESON AND PION ETA-MESON YIELDS PION RHO-MESON REGGE EXCHANGES
W. L. Hogan Mar. 1971 13 p refs Sponsored by NSF
(NUB-2059) Avail: Issuing Activity

Direct channel partial waves are projected from the Regge exchange amplitudes for the processes pion eta-meson yields pion eta-meson and pion eta-meson yields pion rho-meson. For particular choices of Regge residua the Argand diagrams of the partial waves lend qualitative support to the Schmid hypothesis that the Regge amplitude contains the direct channel resonances. Author

N71-24330 California Univ., San Diego.
SMALL CLUSTER THEORY OF THE ELECTRONIC STRUCTURE OF DISORDERED SYSTEMS
William Hill Butler (Ph.D. Thesis) 1969 178 p
Avail: Univ. Microfilms: HC $8.20/Microfilm $3.00 Order No. 70-7932

It is shown that the electronic structure of a system having no long range order is a local property. The density of states density at a point x, −1/pi Im G(x,x,E+io) where G is the one electron Green's function, depends only upon the positions of the atoms which are within a region of extent l, surrounding the point x. The l is of the order of the electronic mean free path. It is also shown that it is possible to treat the electronic structure of a macroscopic disordered system by averaging over an ensemble of neighborhoods. It is necessary to treat the boundary of these neighborhoods or clusters carefully in order to avoid errors of order d/L where L is the characteristic dimension of the cluster and d is a characteristic atomic dimension. One must also choose an ensemble which allows fluctuations in the mean density in order to avoid errors of order 1/N where N is the number of atoms in the cluster. Dissert. Abstr.

N71-24341 California Univ., Los Angeles.
PROTON TOTAL REACTION CROSS SECTIONS FOR LIGHT NUCLEI BETWEEN 24 AND 48 MeV
William Fleming McGill (Ph.D. Thesis) 1969 104 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 70-8247

Total reaction cross sections for protons incident on beryllium, carbon, oxygen, fluorine, aluminum, and silicon were measured at energies of 45.9, 42.9, 39.5, 36.6, 34.0, 30.3, 27.2, and 24.5 MeV. A beam attenuation technique was used. A gradual decrease with increasing energy was observed for all nuclei studied. A comparison of the results with existing optical model analyses indicated excellent agreement for aluminum and silicon. Agreement was fair for oxygen and carbon, and poor for beryllium. Differential cross sections for aluminum were measured at energies of 25.2, 30.8, 34.7, 40.7, and 47.3 MeV, and differential cross sections for silicon were measured at energies of 25.2, 34.7, 40.7, and 47.3 MeV. These data include angles between 20 deg and 125 deg and were measured in order to obtain correction terms for the reaction cross section measurements. Optical model analyses of these data were made, and agreement with experimental values was excellent. Dissert. Abstr.

N71-24342 Duke Univ., Durham, N.C.
THE SUBMILLIMETER MICROWAVE SPECTRUM OF OXYGEN
James Samuel McKnight (Ph.D. Thesis) 1969 74 p
Avail: Univ. Microfilms: HC $4.00/Microfilm $3.00 Order No. 70-8655

The submillimeter wavelength N(J) = 1(2) yields 3(2) rotational transition of molecular oxygen was measured to be 424,763.80 + or − 0.20 MHz. The spacing of the six energy levels within the N = 1 and 3 states is independently determined by combining the rotational frequency with new measurement of the four millimeter wavelength fine structure transitions within these levels. From the separation of the 1(1) and 3(3) energy levels and with consideration for the second order effect of the fine structure constant a new value of 43,100.547 + or − 0.024 MHz was determined for the rotational constant B sub o. After correcting the rotational constant for vibrational and electronic contributions the equilibrium internuclear distance r sub e was found to be 1.20762 + or − 0.00002 Angstroms. Dissert. Abstr.

N71-24343# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
NEW RESULTS IN THE QUARK PARTON MODEL
O. Nachtmann Feb. 1971 22 p refs
(LPTHE-71/12) Avail: NTIS

The quark parton model for deep inelastic lepton-hadron scattering is analysed using the powerful tools of SU(3)-invariance and positivity. It is found that the model predicts the structure functions for electro- and neutrino production to lie in certain positivity domains, which are given explicitly. A comparison with available data and predictions for neutrino experiments are made. Author

N71-24344# Laboratoire de Physique Theorique et Des Hautes Energies, Orsay (France).
A KIND OF 'REALISTIC' DUAL N-MESON AMPLITUDES
L. Gonzalez Mestres Feb. 1971 46 p refs
(LPTHE-71/11) Avail: NTIS

An algorithm is presented allowing the construction of dual N-meson amplitudes incorporating any kind of linear trajectories. These amplitudes are of the type in which a polynomial modifies the Chan integrand. At the leading level we have neither degeneracy nor ghosts. The degeneracy is finite at any nonleading level but the problem of negative-residue ghosts on the nonleading trajectories is somehow worse than for the ordinary N-point B-functions. Author

N71-24347# Los Alamos Scientific Lab., N.Mex.
TWOTRAN SPHERE: A FORTRAN PROGRAM TO SOLVE THE MULTIGROUP TRANSPORT EQUATION IN TWO DIMENSIONAL SPHERICAL GEOMETRY
K. D. Lathrop and F. W. Brinkley Sep. 1970 23 p refs
(Contract W-7405-ENG-36)
(LA-4567) Avail: NTIS

Finite difference techniques peculiar to the solution of the Boltzmann transport equation in two dimensional spherical geometry are given. Programming information and input instructions are given for a FORTRAN program to solve the transport equation in this geometry. Author (NSA)

N71-24348# Stanford Linear Accelerator Center, Calif.
PHYSICS OF ELECTRON STORAGE RINGS: AN INTRODUCTION
Matthew Sands Nov. 1970 172 p refs
(Contract AT(04-3)-515)
(SLAC-121) Avail: NTIS

The basic principles of storage rings are discussed, and the theory of the basic single particle processes which determine the ultimate limits on the performance of storage rings are studied in detail. Betatron oscillations, energy oscillations, radiation damping, radiation excitation, and the luminosity of a high energy storage ring are discussed. NSA

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N71-23243# Howard Univ., Washington, D.C. Dept. of Physics.
INTERACTION OF RADIATION WITH MATTER Final Report
Harold Mendlowitz 31 Dec. 1970 5 p refs
(Contract N00014-66-C-0256)
(AD-718894) Avail: NTIS CSCL 20/9

The paper discusses the work in the general area of electromagnetic properties of various systems, i.e. gases, solids, plasmas, the absorption of radiation in gases as well as in the thermodynamic properties of systems. Author (GRA)

N71-23246# Colorado State Univ., Fort Collins. Dept. of Mechanical Engineering.
INVESTIGATIONS ON THE FORMATION AND PROPAGATION OF THE PLASMA IN MHD CHANNEL FLOWS Annual Technical Report, 1 Jan. - 31 Dec. 1970
Horst E. Wilhelm 15 Jan. 1971 145 p refs
(Contract N00014-67-A-0299-0008)
(AD-718895; ATR-2) Avail: NTIS CSCL 20/9

The report contains specific investigations relevant to plasmas in energy conversion systems: The random walk theory was applied to the relaxation of the energy distribution of the electrons during the breakdown of helium gases in strong electric fields under the consideration of elastic, excitational, and ionizational collisions; The initial-boundary-value problem of the relaxation of an initial ionization distribution, produced by a strong breakdown field, into a steady-state discharge with a weak electric field in a gaseous flow was treated in the collective diffusion approximation; The nonlinear boundary-value problem for a discharge, in which ionization balances the plasma losses by diffusion and recombination, was solved rigorously. An approximate solution of the corresponding initial-boundary-value problem was derived by means of a nonlinear transformation; A novel wave-meachnical description was established for many component plasmas, in which the particles interact by the self-consistent electromagnetic field, for possible applications in turbulence theory. Author (GRA)

N71-23285# Queens Univ., Belfast (Northern Ireland). Dept. of Physics.
DIFFUSION PLASMA AND DIFFUSION Final Report
K. G. Emeleus Wright-Patterson AFB, Ohio ARL Dec. 1970 22 p refs
(Grant AF-EOAR-42-67)
(AD-718430; ARL-70-0277) Avail: NTIS CSCL 20/9

The mechanism of diffusion, and some boundary problems, have been investigated in both electropositive (ep) and electronegative (en) gases. A method is described for distinguishing between diffusion-dominated and recombination-dominated ep negative glows, recombination being either collisional-radiative or dissociative in practice. In an ep negative glow and Faraday dark space, the mode of diffusion changes from nearly ambipolar to nearly free as the wall sheath expands on proceeding away from the cathode, until the resulting throttling is relieved by formation of a positive column via an intermediate shock-like layer and complex double space-charge. Diffusion into a side-arm involves a similar ambipolar to free transition with unrelieved closure. A survey made of the literature on production of metastable atoms and molecules in discharge tubes has shown that whilst a wide range of discharge forms may be employed, conditions in few are known in sufficient detail for plasma data to be used with confidence in deriving forbidden radiation lifetimes and quenching collision cross-sections. Author (GRA)

N71-23917 Princeton Univ., N.J.
SOME INVESTIGATIONS OF WAVE PARTICLE INTERACTIONS
William L. Kruer (Ph.D. Thesis) 1969 138 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 70-8374

Wave-particle interactions were investigated. Special attention was given to higher order effects such as wave scattering by fast particles and to nonexpandable effects such as the broadening of the wave-particle resonance and particle trapping by large amplitude waves. The potential produced by a fast particle following a nonuniform orbit in a cold plasma is expressed as an integral over the particle orbit. The potential in the wake of an accelerating particle is shown to be that produced by local excitation of the plasma by a particle free-streaming about its instantaneous orbit. Application is made to one dimension (the charge sheet model), and it is shown that the emission and absorption synchronize with the instantaneous velocity distribution function. Dissert. Abstr.

N71-23918# P. E. C. Research Associates, Inc., Louisville, Ky.
QUANTUM MECHANICAL STUDY OF PLASMAS. PART 1: INTERACTION OF WAVES WITH PLASMA DENSITY GRADIENTS Final Report
Neil Ashby and Philippe Boulanger Wright-Patterson AFB, Ohio ARL Oct. 1970 210 p refs
(Contract F33615-69-C-1554)
(AD-718436; ARL-70-0245-Pt-1) Avail: NTIS CSCL 20/9

An improved statistical model for electrons in atoms is developed based on an expansion of the one-electron Greens function in spherical harmonics. Improved results in the total energies and electron densities near the nucleus, as compared with the Thomas-Fermi model, are obtained. The model is generalized to include relativistic effects. An improved treatment including retardation effects of surface plasmon dispersion relations, and of the transmission and reflection coefficients for light incident on a semi-infinite plasma, is given. An exact method for solution of a system of coupled differential equations with periodic coefficients is discussed and applied to electromagnetic wave propagation through a gas of spins, and to the Bloch equations for a magnetic moment in an oscillating magnetic field. Author (GRA)

N71-23919# Colorado State Univ., Fort Collins. Dept. of Electrical Engineering.
CAUSES, EFFECTS AND DIAGNOSTIC MEASUREMENTS

OF THE REENTRY PLASMA SHEATH
James P. Rybak Dec. 1970 66 p refs
(Contract F19628-70-C-0035)
(AD-718428; AFCRL-70-0707; SR-1) Avail: NTIS CSCL 20/9

During entry into the earths atmosphere of a manned or unmanned space vehicle, a plasma sheath envelops the vehicle because of shock heating of the ambient gases and ablation of the heat shield material. This plasma sheath causes the interruption of radio communications between the space vehicle and ground based stations commonly referred to as the reentry communications blackout. To solve the blackout problem, a knowledge of the reentry plasma sheath properties (electron density, electron collision frequency, electron temperature and plasma stand-off distance) is required. A summary of the causes and effects of the reentry plasma sheath is presented in this report together with a discussion of reentry plasma diagnostic techniques and review of the flight experiments performed to determine the properties of the reentry plasma. Author (GRA)

N71-23920 North Carolina State Univ., Raleigh.
THE REVERSE CURRENT INDUCED IN A PINCHED PLASMA BY INJECTION OF AN INTENSE RELATIVISTIC ELECTRON BEAM
James Lester Cox, Jr. (Ph.D. Thesis) 1969 67 p
Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 70-9176

A macroscopic treatment of the current density induced in a pinched plasma discharge by the penetration of the plasma by a pulsed relativistic electron beam is presented. The density of the plasma is assumed to be much larger than the density of the injected beam, and the dimensions of the plasma are assumed to be much larger than those of the beam pulse. The behavior of the plasma is characterized by the generalized Ohm's law which takes account of the inertia of the plasma electrons in addition to momentum transfer collisions between the plasma electrons and ions. The induced current density is found to have both longitudinal and radial oscillations near the plasma frequency for nu sub m less than 2 omega sub p, where nu sub m is the collision frequency between plasma electrons and ions and omega sub p is the plasma frequency of the plasma electrons. However, when nu sub m is greater than 2 omega sub p these oscillations disappear. The total induced current parallel to the beam axis is also calculated and examined for the general case in which the beam current density varies slowly for times on the order of the plasma response time. Dissert. Abstr.

N71-23932*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RESULTS OBTAINED IN NASA LEWIS CLOSED-CYCLE MAGNETOHYDRODYNAMIC POWER GENERATION EXPERIMENTS
Ronald J. Sovie and Lester D. Nichols Washington Apr. 1971 17 p refs
(NASA-TM-X-2277; E-6158) Avail: NTIS CSCL 20I

Experiments were performed over a wide range of operating conditions with two magnetohydrodynamic channels. Both channels contained 28 pairs of thoriated tungsten electrodes. In the first channel (length, 195 cm; height, 19 cm; and width, 6.35 cm) open-circuit voltages up to 70 V (0.75 theoretical) were obtained. However, short-circuit currents were limited to 100 to 200 mA at equilibrium conditions and to 100 to 800 mA when preionizers and starter circuits were used. The experimentally determined apparent Hall parameter varied from 0.1 to 0.5 for these conditions. The data indicated that large voltage drops near the electrode surfaces were limiting the short-circuit currents. The second channel was used in an attempt to increase the open-circuit voltage and overcome these losses. In this channel, the width was reduced to 3.8 cm in the electrode region. The effects of internal wall and boundary-layer current leakage were accentuated in this channel, however, and the open-circuit voltage was decreased. Short-circuit currents near the expected equilibrium values were obtained at values of the Hall parameter of about 1. These currents decreased sharply as the magnetic field was increased. Author

N71-23959*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MICROWAVE CAVITY FOR MEASUREMENT OF IONIZATION DUE TO MeV ELECTRON BEAM
James A. Dayton, Jr. Washington Apr. 1971 5 p refs
(NASA-TM-X-2279; E-6162) Avail: NTIS CSCL 20I

A microwave cavity which can be penetrated by an electron beam in the MeV range and which can be evacuated to 10 to the minus 8th power torr and baked at 200 C is described. The electron beam is admitted through titanium foil welded to one end of the copper body of the cavity; targets of a variety of materials may be brazed to the other end. The design permits all brazed joints to be thoroughly cleaned before the final seal, an electron beam weld, is made. Author

N71-23966# Aerospace Corp., El Segundo, Calif. Lab. Operations.
THE EFFECTS OF SPATIAL NONUNIFORMITIES ON HIGH TEMPERATURE MICROWAVE BREAKDOWN Technical Report, Aug. 1969–Jun. 1970
Glenn C. Light 2 Feb. 1971 31 p refs
(Contract F04701-70-C-0059)
(AD-718412; TR-0059(6220-10)-6; SAMSO-TR-71-26) Avail: NTIS CSCL 20/9

Microwave breakdown over an X-Band waveguide aperture in a ground plane is studied experimentally and theoretically. Experimental data are presented for cw and pulsed breakdown in air and in nitrogen. Calculations based on recent analyses for the effects of nonuniformities on breakdown are made for this geometry and results are compared with experimental data. Calculations of breakdown are compared using first, the classical phenomenological data set for the fundamental breakdown parameters and second, recently reported values for these parameters from a numerical integration of the Boltzman equation with cross sections for air. The effects of the unsteady laminar compressible boundary layer on breakdown in recent shock tube experiments are evaluated. Calculations are made for breakdown in typical conical reentry vehicle boundary layers including the effects of boundary layer and electric field nonuniformities; results are compared for various simplifying assumptions. The major conclusions are that recent theories for the effects of nonuniformities on breakdown are entirely adequate and that the effects of boundary layers in recent shock tube breakdown experiments were generally negligible. Author (GRA)

N71-23968*# National Aeronautics and Space Administration, Washington, D.C.
LOW FREQUENCY OSCILLATIONS IN THE HOT CATHODE PENNING DISCHARGE PLASMA [NIZKOCHASTOTNYE KOLEBANIYA V PLAZME RAZRYADA PENNINGA S NAKALENNYM KATODOM]
V. G. Nsumovets et al Apr. 1971 21 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 15, no. 3, 1970 p 377–391
(NASA-TT-F-13641) Avail: NTIS CSCL 20I

Low frequency oscillations were investigated in the range 1 to 100 KHz in a hot cathode penning discharge plasma. The oscillations were caused by a density wave moving in the direction of plasma drift in crossed electric and magnetic fields. Azimuthal modes m = 1, 2, and 3 were observed. Data on the dependence of critical magnetic fields for the onset of oscillations with modes m = 1, 2 and 3 on the discharge parameters were obtained. The ranges of discharge parameters for the existence of different mode oscillations were determined. Data on the behavior of the frequency and amplitude of oscillations with changing discharge conditions

and on the effect of the latter on plasma parameters are outlined. Possible reasons for the onset of oscillations are discussed. Author

N71-24014# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
EXPERIMENTAL DETERMINATION OF ARGON PLASMA TRANSPORT PROPERTIES Final Report
Paul W. Schreiber, Allen M. Hunter, II, and Kenneth R. Benedetto Nov. 1970 32 p refs
(AD-718102; ARL-70-0262) Avail: NTIS CSCL 20/9

Measurements of the plasma transport properties of argon at atmospheric pressure are presented. The properties included in the study are electrical and thermal conductivity, radiation source strength, and viscosity as functions of the plasma temperature. The plasma source used for this study consists of a one-inch diameter, wall-stabilized, pulsed discharge with laminar, developed, axial flow at small Mach numbers. Data are collected by utilizing probe and optical diagnostics. The diagnostic techniques enable the plasma transport properties to be calculated using fewer assumptions than conventional methods. Author (GRA)

N71-24051 Princeton Univ., N.J.
A NUMERICAL MODEL FOR A LOW PRESSURE PLASMA IN A TOROIDAL MAGNETIC FIELD
Niels Karl Winsor (Ph.D. Thesis) 1969 149 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 70-8397

In the presence of toroidal curvature and resistivity, initial flow is necessary to obtain a quasistatic density. In addition, enhanced resistive diffusion is observed and plasma rotation is found to develop. For reasonable stellarator parameters, the initial data must include parallel velocities which reach ten percent of the ion sound speed. The material flux scales with temperature, magnetic field intensity, and magnetic field rotational transform. The time behavior includes the development of counterrotating plasma layers. Outside the region of maximum density gradient, the plasma rotates with one sense; inside, it rotates with the opposite sense. This behavior is explained in terms of asymmetries in the diffusion process. Dissert. Abstr.

N71-24061# Sperry Rand Research Center, Sudbury, Mass.
EXPERIMENTAL AND THEORETICAL STUDIES INTO PULSE AND WAVE PHENOMENA IN PLASMAS Final Report, 15 Oct. 1969 - 30 Sep. 1970
Albert W. Baird and Claude D. Lustig Nov. 1970 20 p refs
(Contract F19628-70-C-0092)
(AD-717957; SRRC-CR-70-25; AFCRL-70-0648) Avail: NTIS CSCL 20/9

The report describes an investigation of methods for measuring the electron density in a reentry shaft. The methods include excitation of electroacoustic resonances and the observation of enhanced microwave breakdown. Good agreement is obtained between electron density profiles determined from electroacoustic resonance frequencies measured for a laboratory plasma and those calculated theoretically. If higher order resonances can be observed, departures of the profile from linearity can be obtained. Measurements of enhanced breakdown in a laboratory plasma under simulated reentry conditions suggest that this method should be feasible for some reentry plasmas. A hollow cathode plasma source was constructed in an attempt to simulate low altitude reentry plasmas. Author (GRA)

N71-24101 National Lending Library for Science and Technology, Boston Spa (England).
LIGHTNING IN A SPHERE
29 Jul. 1970 2 p Transl. into ENGLISH from Pravda (Moscow), 29 Jul. 1970
(NLL-M-20301-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Eng.: 1 NLL photocopy coupon

An experiment using the high capacity, high frequency generators planotron and nigotron is reported. The power generated was passed through a quartz sphere filled with helium, resulting in a sharply-outlined discharge in the gas. A few seconds later the quartz melted away. The existence of a high temperature plasma inside the discharge was demonstrated. N.E.N.

N71-24143 Texas A&M Univ., College Station.
INVESTIGATION OF SHOCK FORMED IN THE FLOW OF PLASMA INTO A MAGNETIC FUNNEL
Eugene Alan Dean (Ph.D. Thesis) 1969 89 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 70-9679

Thompson scattered laser light from plasma was used to determine the time resolved electron density and temperature of the shock formed in the axial injection of plasma into a dipole magnetic field. The measurements were obtained in a region upstream from the throat of the magnetic funnel for low-beta hydrogen, deuterium, and helium plasmas accelerated by a conical pinch tube. The observed increase in electron temperature cannot be explained by compression since the temperature peak occurred prior to the maximum density. A hybrid shock involving a collisionless transfer of longitudinal to transverse ion energy due to the magnetic field gradient and electron heating due to Coulomb collisions with ions is consistent with the observed electron temperature and density time history. The thermalization of cold electrons and hot ions is shown to be sufficiently fast to provide the observed increase in entropy across the shock front. Dissert. Abstr.

N71-24213 National Lending Library for Science and Technology, Boston Spa (England).
THE INFLUENCE OF THE RESONANCE STRUCTURE OF THE MAGNETIC FIELD ON THE CONTAINMENT OF COLLISIONLESS PLASMA IN THE TOR-1 STELLARATOR
E. D. Andryukhina et al 7 Jan. 1971 13 p refs Transl. into ENGLISH from Russian preprint
(NLL-CTO-740-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The influence of the magnetic field rosette structure on the plasma lifetime is examined. The resonance perturbations of the magnetic field in the stellarator near the strongest resonance were compensated, the magnetic field structure was investigated, and the dependence of the plasma lifetime on the magnetic field structure was measured. It was found that the lifetime remains unaltered when the magnetic field structure is changed. It is assumed that the sharp reduction in lifetime near the resonance values of the rotational transform angle is not due to a breakdown of the regular field structure by the action of the resonance perturbations. Author

N71-24260 Texas Univ., Austin.
VARIABLE SENSITIVITY OPTICAL MACH-ZEHNDER AND HOLOGRAPHIC INTERFEROMETRY FOR PLASMA DIAGNOSTICS
Frederic Weigl (Ph.D. Thesis) 1969 119 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 70-10883

Techniques both to increase and decrease the sensitivity of nondiffuse optical holographic interferometry for use with transparent experimental media are developed. Applications to plasma diagnostics are emphasized. The simultaneous recording of double-exposure holographic interferograms at two or more optical wavelengths is discussed. Two experimental techniques to accomplish this are investigated experimentally using a pulsed argon laser and Polaroid 55 P/N film. One technique uses a single multiple-wavelength reference beam, while the other uses mul-

tiple single-wavelength reference beams. These experiments demonstrate the feasibility of extending the two wavelength interferometry technique of Alpher and White to holographic systems. These techniques are useful in the study of weakly ionized plasmas. A technique to increase the sensitivity of nondiffuse holographic interferometry by multiply passing the test laser beam through the experimental medium is also developed. Dissert. Abstr.

N71-24267 California Univ., Los Angeles.
STIMULATED SECONDARY RESONANCES IN THE IONOSPHERIC PLASMA
James Dale Barry (Ph.D. Thesis) 1969 350 p
Avail: Univ. Microfilms: HC $15.75/Microfilm $4.50 Order No. 70-8111

A set of infrequently detected resonance-like traces in the Alouette II ionogram data is described. Several source processes for the secondary resonance signals are discussed. Calculations of the production rates of the metastable states of oxygen (O, O+) and nitrogen (N,N+) are made from 500 to 2000 km. The production process is assumed to be the photoionization and photodissociation of the parent molecules and atoms. The wavelength dependent solar EUV fluxes, and the wavelength dependent cross sections for the various species are used in the calculations. An unexpected feature is the relatively significant production rates for O+(D-2), O(D), and N(D-2) at altitudes above 500 km. Dissert. Abstr.

N71-24268 Cornell Univ., Ithaca, N.Y.
SOME TOPICS IN MAGNETOHYDRODYNAMICS
John David Buckmaster (Ph. D. Thesis) 1969 102 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 70-11219

An investigation of MHD boundary layers in a transverse magnetic field when the magnetic Reynolds number (Rm) is small and the suppression of separation by a strong magnetic field, with particular emphasis on the behavior near a rear stagnation point are analyzed. Given an O(1) inviscid flow it is shown that there is a critical value of N, the interaction parameter, to completely suppress separation. The equations of inviscid magnetohydrodynamics are also studied for small Rm and Large N. Similarity solutions are obtained for two kinds of layers, one perpendicular to the magnetic field and the other parallel to the magnetic field. The parallel layers are backward jets and constitute the most important result. Also considered is the impulsively started flow around an insulator in a perfectly conducting inviscid liquid. Dissert. Abstr.

N71-24269 Princeton Univ., N.J.
THEORY OF AN ELECTROSTATIC PROBE IN A STATIONARY QUIESCENT PLASMA
Kuo-wei Chang (Ph.D. Thesis) 1969 137 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 70-8352

The electrical effects of a biased sphere immersed in a weakly ionized gas of infinite extent are analyzed on the basis of kinetic theory. Solutions are obtained by the application of a moment method in which the velocity space is split according to an exact orbit calculation, self-consistent with the field. Results are shown to reproduce both the collisionless and the continuum solutions in the appropriate limits. A detailed asymptotic analysis is performed for small Debye length but arbitrary mean free path and criteria for the collisionless or collision dominated sheath are obtained explicity. The current-voltage characteristics are presented in a form useful for direct prediction of electron number density in terms of measured current and coltage, provided the mean free path is known. Dissert. Abstr.

N71-24273 California Univ., Los Angeles.
NONLINEAR WAVE INTERACTIONS IN A MAGNETOACTIVE PLASMA
Guy Michael Weyl (Ph.D. Thesis) 1969 118 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 70-8222

The nonlinear interactions of two electromagnetic waves resulting in the excitation of electrostatic oscillations of a homogeneous plasma in a strong magnetic field are studied. The scattering cross section for electromagnetic radiation per electron due to the excited electrostatic oscillation is calculated and compared to the cross section due to thermal fluctuations. The results are applied to a laboratory Q device using ruby lasers as sources of the electromagnetic waves and to an ionospheric plasma using radio waves. The parametric excitation of drift waves in an inhomogeneous resistive plasma is derived from fluid equations. Dissert. Abstr.

N71-24326 Stanford Univ., Calif.
NONLINEAR TRANSPORT OF ELECTRONS AND IONS IN A PLASMA DIODE
Didier Francois Biron (Ph.D. Thesis) 1969 106 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 70-10427

A general theory of the interelectrode plasma in a thermionic converter is presented. A set of Boltzmann equations for the velocity-dependent angular fluxes, together with Poisson's equation, is used to describe the charged particle distribution. In order to get analytical results, part of the accelaration term is neglected; the introduction of a transform allows the reduction of each Boltzmann equation to an equivalent one-speed neutron transport problem. A set of complete eigenfunctions is then derived, and it is shown that general boundary conditions can be satisfied. The solution of the problem is thus reduced to that of an Hammerstein integral equation. In cases where uniqueness of solutions is obtained, the iterative technique is seen to give excellent results for both the ignited and unignited modes. Dissert. Abstr.

N71-24331 California Univ., Los Angeles.
EFFECTS OF ION-ION COLLISIONS AND ION WAVE TURBULENCE ON THE ION WAVE ECHO
Dan Ross Baker (Ph.D. Thesis) 1969 102 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 70-8109

Diffusion of particles in velocity space due to ion-ion collisions and due to the interaction of ions with a turbulent spectrum of waves is experimentally measured in a highly ionized plasma using the spatial ion wave echo as a diagnostic techniqus. The ion-ion collisions are described by a Fokker-Planck term in the ion kinetic equation. The good agreement between the measurement of the echo position, phase velocity, and amplitude with the theoretical predictions indicates that the diffusion term of the Fokker-Planck equation is appropriate for describing the effect of small angle Coulomb collisions as they affect the streaming particles resulting from the excitation of ion waves. The interaction of particles with a turbulent wave spectrum can also be described by a diffusion equation for the velocity distribution function. The magnitude of the second order coupling coefficient relating the amplitudes of the excited waves to the echo amplitude was also measured. Dissert. Abstr.

N71-24345 Cornell Univ., Ithaca, N.Y.
THE BEHAVIOR OF AN IONIZED GAS IN A HOMOPOLAR DEVICE
Stephen Alan Diamond (Ph.D. Thesis) 1969 171 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 70-5784

The rotation of the discharge is studied, with emphasis on determining what species in the lightly ionized gas are in motion and what is the mechanism causing rotation of the discharge. Argon and helium data were taken over a pressure range of one to fifty torr, with magnetic field strengths up to three kilogauss.

An externally imposed radial flow was necessary to combat the sputtering of impurities from the cathode. Rotational data was acquired by measuring the time between consecutive arrivals of the leading edge of the discharge at a fixed electrostatic probe. Magnetic fields and high pressures constrain the discharge in an azimuthal direction. High pressure argon discharges contracted severely, both in azimuth and away from the walls of the homopolar. It is proposed that this rotational rate is due to new charged species being created outside the discharge proper by high energy electrons in the vicinity of the leading edge of the rotating discharge. Author

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N71-23146# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).

OPTICAL PROPERTIES OF SOME COMPOUND SEMICONDUCTORS IN THE 36-150 eV REGION

Manuel Cardona and Ruprecht Haensel [1970] 29 p refs Prepared jointly with Hamburg Univ.

Avail: NTIS

The absorption spectra of evaporated thin films of ZnS, CdS, ZnSe, CdSe, ZnTe, CdTe, PbS and PbTe in the 36 to 150 eV region are reported. The measurements were performed using the DESY electron synchrotron as a radiation source. A sharp doublet associated with transitions from the 3p core levels of Zn to the conduction bands is observed for ZnS, ZnSe and less clearly for ZnTe. The splitting of this doublet seems due to spin-orbit interaction. Other less pronounced structure is also observed but most spectra are dominated by broad transitions similar to the atomic d yields f transitions observed in this region for Kr and Xe. The number of effective electrons whose oscillator strength was exhausted at a given energy is obtained by integrating the absorption coefficient. In the compounds containing the heavy elements Te and Pb all outermost d-electrons of the core have exhausted their oscillator strength at 150 eV. Author

N71-23170 Purdue Univ., Lafayette, Ind.

CRYSTALLOGRAPHIC AND TRANSPORT STUDIES OF THE TiO-VO and Ti2-03-V203

Ronald Ernest Loehman (Ph.D. Thesis) 1969 147 p

Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 70-8918

The cell parameters of pure, arc melted Ti2O3 were investigated as a function of temperature by X-ray diffraction techniques. It was found that there is no change in crystal symmetry in the 300 to 550 K range, although a marked change in cell parameters sets in at about 380K. This correlates well with the temperature of the onset of the electrical transition in Ti2O3. A crystallographic study of (V sub x Ti sub 1-x)203 (0 < or = x < or = 1) showed that solid solutions are formed over the entire composition range but that there are marked deviations from Vegard's law. The Seebeck coefficient of highly purified single crystal Ti2O3 was measured between 80 and 410K, yielding values of alpha between +40 and +80 microvolts/deg, a result consistent with a two band description of Ti2O3. A measurement of the thermal conductivity of single crystal Ti2O3 was made at 300K, giving kappa = 0.044 + or - 0.004 watt/cm deg. Magnetoresistance measurements were carried out on V-doped Ti2O3 for vanadium concentrations between 0.71 and 4.6 atomic per cent, at fields up to 23 kG for temperatures between 0.43 and 4.2K. Dissert. Abstr.

N71-23207# Naval Ordnance Lab., White Oak, Md.

Pb(1 - x)Sn(x)Se EPITAXIAL FILMS

H. Raymond Riedl and Peter Scharnhorst 21 Dec. 1970 31 p refs

(AD-718323; NOLTR-70-233) Avail: NTIS CSCL 20/2

Single-crystal films of lead-tin-selenide have been prepared by vacuum-evaporation techniques, and subsequently heat treated under various conditions. The purpose of the study was to develop the procedures for growing this compound in the form of single crystal films, and secondly, to learn to control the carrier concentration of these films. The report includes: synthesis of the compound, growth of the film, determination of film thickness, determination of lead-to-tin ratio, electrical properties, vacuum annealing, isothermal annealing, and two-zone annealing. Author (GRA)

N71-23242# Stanford Univ., Calif. Center for Materials Research

SYNTHESIS OF COMPOUND SEMICONDUCTING MATERIALS AND DEVICE APPLICATIONS Semiannual Technical Report, 1 Jul. - 31 Dec. 1970

D. A. Stevenson 31 Dec. 1970 52 p refs

(Contract DAHC 15-70-G-12; ARPA Order 1644)

(AD-718878; CMR-71-4) Avail: NTIS CSCL 20/12

The objective of this program is to improve the knowledge and state of the art concerning compound semiconducting materials with particular emphasis on their use in practical devices. The program consists of three principal sections: epitaxial crystal growth; device application; and fundamental materials studies. The epitaxial crystal growth section concerns the preparation of material suitable for the device applications. The major emphasis in device application is on microwave and acoustical devices using thin film GaAs. The materials studies concern scientific aspects of crystal preparation and the properties of crystals of compound semiconductors. During the initial phase of the program, there has been significant progress on the preparation of thin films of GaAs using liquid phase epitaxial growth techniques. Initial problems concerning surface morphology and purity have been solved and wafers suitable for device fabrication are now being produced. Studies of device applications are in their initial phases. In the materials studies, the initial activity has concerned the construction of relevant apparatus and the development of specific techniques required to approach each program. Author (GRA)

N71-23286# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

A STUDY OF THE LOCAL LEVELS IN Sb2Se3, SINGLE CRYSTALS, GROWN FROM THE GAS MEDIUM

B. Grigas et al 2 Dec. 1970 19 p refs Transl. into ENGLISH from Akad. Nauk Lit. SSR, Liet. Fiz. Rinkinys (Vilnyus), v. 9, no. 2, 1969 p 369-379

(AD-717879; FTD-MT-24-244-70) Avail: NTIS CSCL 20/12

Results are given of an experimental investigation of dark and thermally stimulated conductivity, the spectral distribution of photoconductivity, induced photoconductivity and optical extinction of photoconductivity in Sb2Se3, single crystals, grown from the gas medium at different pressures of saturated selenium vapors. On the basis of these data the energy spectra of levels of adhesion is discussed. The questions of obtaining stoichiometric Sb2Se3 single crystals from the gas medium is also discussed. Author (GRA)

N71-23272# Pennsylvania State Univ., University Park. Dept. of Physics.

SEMICONDUCTOR SURFACE STUDIES Final Report, 1 Nov. 1964 - 31 Oct. 1970

Daniel R. Frankl 15 Jan. 1971 13 p refs

(Contract Nonr-656(34))

(AD-717960) Avail: NTIS CSCL 20/12

A variety of projects centering on the theme of particle interactions with surfaces of both semiconductors and semimetals has been carried out. Research projects included the following: Surface mobility of electrons in germanium; Infra-red emission from germanium diodes; Bismuth thin films; Thermal conductivity; and, Atomic beam diffraction. GRA

N71-23292* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

Gd OR Sm DOPED SILICON SEMICONDUCTOR COMPOSITION Patent

Joseph Mandelkorn, inventor (to NASA) Issued 5 Nov. 1968 (Filed 20 Dec. 1966) 2 p Cl. 252-62.3 Continuation-in-part of US Patent Appl. SN-352400, filed 28 Mar. 1967

(NASA-Case-XLE-10715; US-Patent-3,409,554; US-Patent-Appl-SN-603397) Avail: US Patent Office CSCL 20L

A semiconductor material having improved resistance to radiation damage is described. Silicon combined with an electrically active impurity selected from the rare earth elements which reduces the number of recombination centers and trapping centers while increasing the conductivity of the silicon.

Official Gazette of the U.S. Patent Office

N71-23358# Signals Research and Development Establishment, Christchurch (England).

ION IMPLANTATION OF ZINC SULPHIDE THIN FILMS

M. R. Brown, A. F. J. Cox, W. A. Shand, and J. M. Williams Aug. 1970 8 p

(SRDE-70046) Avail: NTIS

The use of ion implantation as a means of preparing rare earth doped thin films of zinc sulfide is considered and preliminary results are presented on the luminescence of such films doped with terbium and erbium 166 ions. Author (ESRO)

N71-23359# Signals Research and Development Establishment, Christchurch (England).

THE EXCITATION MECHANISMS OF RARE EARTH EMISSIONS IN THE THIOINDATES

M. R. Brown and W. A. Shand Jun. 1970 20 p refs

(SRDE-70028) Avail: NTIS

The excitation processes for Er(3+) emissions in the thioindate lattices CdIn2S4, ZnIn2S4 when excited by Stokes and anti-Stokes modes were studied. It has been found that in the anti-Stokes case the lattice itself is of little importance since the processes only involve the interactions between the rare earth ions. Under Stokes excitation, however, the lattice is all important since the processes involve the nonradiative transfer of the energy, provided by the recombination of electron-hole pairs, to the rare earth ion. In this case there are competing mechanisms for the recombination energy so the efficiency of excitation of the Er(3+) ions will depend on the balance between these competing mechanisms and thereby depend on the host lattice. Author (ESRO)

N71-23371# Stanford Univ., Calif. Center for Materials Research.

MATERIALS RESEARCH AT STANFORD UNIVERSITY Annual Report, 1 Jul. 1969 – 30 Jun. 1970

Nov. 1970 318 p refs Sponsored by ARPA

(AD-714793; SU-AR-9) Avail: NTIS HC $6.00/MF $0.95 CSCL 11/7

The report contains brief descriptions of the various individual research programs active during the period July 1969 through June 1970, arranged alphabetically by the name of the principal investigator. Also included are lists of publications, doctoral dissertations, faculty and senior staff members, research associates, graduate students and degrees awarded. Finally, a name index is included for convenience in locating references to the activities of specific individuals. Author (GRA)

N71-23613# Case Western Reserve Univ., Cleveland, Ohio. Electrochemistry Research Lab.

ELECTROCHEMISTRY OF REDOX COUPLES ON LITHIATED NICKEL OXIDE ELECTRODES

Dennis M. Tench and Earnest Yeager 15 Sep. 1970 242 p refs

(Contract N00014-67-A-0404-0006)

(AD-718831; TR-28) Avail: NTIS CSCL 7/4

The kinetics of redox couples (Fe(CN)6(-4)/Fe(CN)6(-3), FE(+2)/Fe(+3), Cr(+2)/Cr(+3) and quinhydrone) have been investigated on mosaic NiO(Li) electrodes (0.5 - 0.5 cation % Li), in aqueous sulfate solutions at various pH, using rotating flat electrodes and linear sweep voltammentry. To summarize the redox data, no oxidation or reduction processes occur at potentials very cathodic (>200 mV) to that of the reversible surface reaction (Ni(+2) - Ni(+3)). For oxidation reactions, all of the change in electrode potential is across the Helmholtz region, except at low overvoltages (< 100 mV) and possible when specific adsorption occurs. For reductions, most of this potential change usually occurs across the space charge region of the semiconductor, depending on pH and the system considered. In the absence of redox couples, the differential capacitance exhibits a maximum at the potential of the reversible surface reaction (Ni(+2) - Ni(+3)). At more cathodic potentials, 1/C - E plots are linear with essentially the proper slope for the carrier concentration in the semiconductor, although some frequency dispersion is observed. Author (GRA)

N71-23652 Duke Univ., Durham, N.C.

NUCLEAR MAGNETIC RESONANCE STUDIES IN SOLID HYDROGEN

Larry Ihrig Amstutz (Ph.D. Thesis) 1969 104 p

Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 70-8818

A study of the interactions which tend to quench the free rotation of ortho molecules in solid hydrogen is presented. Nuclear magnetic resonance techniques are used to study the rotation of ortho molecules as a function of both temperature and concentration. The most important angle dependent force is due to the electric quadrupole-quadrupole (EQQ) interaction. Because of the EQQ interaction the ground state energy of the solid is lower when ortho molecules occupy adjacent lattice sites than when ortho molecules are separated by layers of para molecules. Experiments are reported showing that below about 2 K an equilibrium number of isolated ortho molecules different than expected for a random distribution is approached exponentially in time. It is suggested that the rearrangement process occurs by means of ortho-para interchange. A simple model for interpreting the experiments is presented and the temperature dependence of the interchange rate is reported. Dissert. Abstr.

N71-23853# State Univ. of New York, Stony Brook. Dept. of Electrical Sciences.

MAGNETO OPTICAL PROPERTIES OF FERROMAGNETS AND FERRIMAGNETS Final Report

Velio A. Marsocci 30 Sep. 1970 11 p refs

(Grant AF-AFOSR-1844-70)

(AD-718135; AFOSR-70-2612TR) Avail: NTIS CSCL 20/12

The present research project is concerned with an experimental-theoretical study of the magneto-optical properties of poly-crystalline and single-crystal ferromagnetic thin films, and an investigation of the spin-wave spectrum and the spin-Raman effect in Yttrium Iron Garnet. The work also includes a continuation of the projects from the previous grant, involving magnetoresistance measurements on ferromagnetic films and transport phenomena in p-n junctions. The effort on the research phase involving magneto-optical effects has consisted, during the past year, mainly of the implementation of the required experimental set-ups. The studies involving the anisotropies in the magnetoresistance measurements on ferromagnetic thin films have been completed,

and as well as providing new data regarding the magnetoresistivity coefficients have also resolved some of the apparently anomalous results obtained by previous investigators. The theoretical aspects of these studies have also provided more general solutions of the Boltzmann transport equation for conduction in thin films. The work on p-n junction has provided evidence governing relationships between the nature of the mobility of electrons in the space-charge region of the junction and the width of that junction. Author (GRA)

N71-23654* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

SEMICONDUCTOR MATERIAL AND METHOD OF MAKING SAME Patent

Joseph Mandelkorn, inventor (to NASA) Issued 25 Jun. 1968 (Filed 11 Aug. 1967) 4 p Cl. 148-1.5 Continuation-in-part of US Patent Appl. SN-352692, filed 17 Mar. 1964

(NASA-Case-XLE-02798; US-Patent-3,390,020; US-Patent-Appl-SN-660571) Avail: US Patent Office CSCL 20L

A method is described for improving the properties and increasing the resistance to radiation damage of silicon semiconductor material used in solar cells by the selective addition of certain elements, or compounds of the elements, of group 3 of the periodic table. The presence of aluminum atoms results in the formation of less recombination centers while the presence of indium atoms results in the formation of less trapping centers than the presence of atoms of other electrically active impurity elements in equal concentration. Official Gazette of the U.S. Patent Office

N71-23678# Airtron, Inc., Morris Plains, N.J.

RESEARCH IN ZIRCON POLARIZERS Quarterly Report, Oct. – Dec. 1970

Roger F. Belt, Richard C. Puttbach, and Ramanathan Dharmarajan 30 Jan. 1971 38 p refs

(Contract N00014-70-C-0379)

(AD-718851; R11-590-2; QR-2) Avail: NTIS CSCL 20/2

Attempts to grow single crystals of zircon ($ZrSiO_4$) by molten salt and hydrothermal techniques are described. Well developed crystals with (110) and (111) faces were grown up to 4 mm in size from a lithium tungstate melt. The crystal were colored pale to dark brown due to absorption of iron impurities along preferred crystallographic planes. A technique was developed for sintering high purity ZrO_2 and SiO_2 to yield pellets suitable for use as hydrothermal nutrient. High quality hydrothermal zircon growth was achieved on 1 x 1/2 inch (110) faces of natural zircon seed crystals. Experiments were performed in a one-inch platinum system at 500C and 29,000 psi using 3M KF as mineralizer. Author (GRA)

N71-23679# Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy and Materials Science.

INVESTIGATION OF THE SUPERCONDUCTING ENERGY GAP BEHAVIOR OF SINGLE CRYSTAL RHENIUM BY TUNNELING

Shini Ochiai, Margaret L. A. Mac Vicar, and Robert M. Rose 3 Feb. 1971 35 p refs

(Contract N00014-67-A-0204-0041)

(AD-718415; TR-5) Avail: NITS CSCL 20/12

A 15.7% anisotropy in the superconducting energy gap has been measured by electron tunneling into single crystals of rhenium, using thin carbon films as the tunneling barrier to form Re-C-In sandwiches. The energy gap behavior with temperature is BCS-like. The anisotropy agrees with ultrasonic measurements of other hcp metals and suggests that phonon dispersion plays a dominating role in the gap behavior. However, gap values determined from multiparticle tunneling data exhibited reduced gap magnitudes, and a dissimilar crystallographic behavior. Author (GRA)

N71-23735# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

GROWING EPITAXIAL GERMANIUM LAYERS FROM A MELT

Yu. B. Bolkhovityanov et al 17 Nov. 1970 11 p Transl. into ENGLISH from Proc. of Protessy Rosta i Struktura Monokristallicheskikh Sloev Poluprov., Tr. Simpozyuma, 1966 (Novosibirsk), 1968 p 515–519

(AD-718695; FTD-MT-24-245-70) Avail: NTIS CSCL 20/2

An apparatus for the growth of epitaxial Ge films from the melt is described. A Ge plate is immersed for a few sec. in a supercooled Ge melt and withdrawn; depending on the degree of supercooling, the thickness of the epitaxial layer ranges from 10 to 100 mu. The immersion and withdrawal of the plate must be rapid as possible; temperature control is critical, and it should be within plus or minus 0.1 degrees. The growth may be carried out either in vacuo or in H; epitaxial Ge layers grown in H atm. had a resistivity of 2 ohm-cm and a Hall mobility (of e) of 3000 cm(superscript2)/(V-sec). The method may also be used for the growth of InSb and GaSb epitaxial layers. Author (GRA)

N71-23736# Watervliet Arsenal, N.Y.

GROWTH PROCESSES OF INORGANIC WHISKERS

Iqbal Ahmad Dec. 1970 120 p refs

(AD-718248; WVT-7060) Avail: NTIS CSCL 20/2

A general survey of the growth processes of inorganic whiskers has been made. On the basis of the phases involved, these processes have been divided into nine mechanisms. An example for each of these, along with the brief description of the possible mechanisms, have been given. The state of technology of high strength alpha Al_2O_3, SiC, and Si_3N_4 whiskers has also been discussed. It has been emphasized that before the enormous potential of the whiskers can be realized, processes will have to be developed by which whiskers of uniformly high quality and in economical yields can be prepared. Also, techniques must be developed for the complete characterization of these materials. Author (GRA)

N71-23737# Ohio State Univ. Research Foundation, Columbus.

TEMPERATURE AND SULFUR PRESSURE DEPENDENCE OF DIFFUSION OF Yb INTO CdS Final Report, 1 Apr. 1967 – 30 Jun. 1970

W. W. Anderson and Hong Jo Chang Dec. 1970 40 p refs

(Contract DAHC04-67-C-0043)

(AD-718797; OSURF-2419-8; AROD-6835-5-E) Avail: NTIS CSCL 20/12

Diffusion of Yb into CdS was studied as a function of temperature and sulfur pressure in the range of 930C - 990C and 3.3 - 33 atm. Diffusivity and solubility of Yb(3+) are indicated. Author (GRA)

N71-23820# Duke Univ., Durham, N.C. Dept. of Physics.

SOLID STATE STUDIES WITH MICROWAVES Final Report, 1 Oct. 1963 – 30 Sep. 1970

Walter Gordy 21 Jan. 1971 10 p refs

(Grants DA-ARO/D/-31-124-70-G26; DA-ARO/D/-31-124-G1053)

(AD-718796; AROD-4131-35-P) Avail: NTIS CSCL 7/5

The following research topics are briefly summarized: Energy migration and transfer in inert solids at low temperature; Study of hydrogen exchange reactions in solids; Study of information storage molecules; Studies of the attack by thermal H atoms and OH radicals on organic materials; Polyamino acids and proteins; and Studies of irradiated single crystals. Author (GRA)

N71-23911# Harvard Univ., Cambridge, Mass. Engineering and Applied Physics Div.

[SOLID STATE PHYSICS, ELECTRONICS, PLASMA PHYSICS AND CONTROL] Semiannual Progress Report, 1 Jan. – 30 Jun. 1970

Dec. 1970 71 p refs
(Contracts N00014-67-A-0298-0006; N00014-67-A-0298-0005; N00014-67-A-0298-0008)
(AD-718117; SAPR-80) Avail: NTIS CSCL 20/12

Contents: Very low frequency wave propagation; Electron and solid state physics; Control theory and applications; Electronic networks and instrumentation; Physics of ferromagnetic and ferroelectric materials; Electromagnetic phenomena; Antennas and waves in dielectric, conducting, and plasma media; Scattering, diffraction, and surface roughness. GRA

N71-23954# Minnesota Univ., Minneapolis. School of Mineral and Metallurgical Engineering.
A STUDY OF GRAIN BOUNDARY SEGREGATION USING THE AUGER ELECTRON EMISSION TECHNIQUE Annual Technical Progress Report
D. F. Stein, A. Joshi, and P. V. Ramasubramanian 21 Dec. 1970 7 p refs
(Contract AT(11-1)-1778)
(COO-1778-6) Avail: NTIS

The utilization of Auger Spectroscopy to study segregation of impurities that result in a deterioration in properties of a material is outlined. Embrittlement due to grain boundary fracture, corrosion at grain boundaries, and grain boundary mobility during annealing and sintering operations was investigated. Author

N71-23956# Illinois Univ., Urbana. Dept. of Metallurgy and Mining Engineering.
TEMPERATURE CHANGES IN THIN FILMS DURING GROWTH BY PHYSICAL VAPOR DEPOSITION
David Devoe Thornburg (Ph.D. Thesis) 1971 211 p refs
(Contract AT(11-1)-1198)
(COO-1198-775) Avail: NTIS

A theory was developed to determine the temperature of thin film during growth by physical vapor deposition in vacuo from a resistance heated source. The three sources of heat which contribute to the film temperature are radiation losses from the source, kinetic equilibration of the condensing vapor stream, and condensation of the evaporant. By assuming planar geometry for the substrate, the heat equation was solved for the case in which the bottom of the substrate was held at constant temperature and the top surface was subjected to the heat flux described above. Solutions of the heat equation were obtained with the aid of an analog computer. By proposing a model for substrate surface coverage as a function of time during growth, it is shown that when a metal film is deposited on substrates of high emissivity (glass, rocksalt), a plot of film temperature vs time displays a maximum which is correlated to deposition rate. Author

N71-23957# Virginia Univ., Charlottesville. Dept. of Materials Science.
DISLOCATIONS IN CRYSTALS
Roy H. Geiss [1970] 2 p Presented at 26th Ann. Meeting of the Electron Microscopy Soc. of Am., New Orleans, La. Sponsored by AEC
(NYO-3087-19; CONF-680905-5) Avail: NTIS

A brief review is given of the methods used in obtaining quantitative data on dislocation structures in crystal materials. The determination of Burger's vectors, glide planes, and densities of the various dislocations is discussed including the analysis of micrograph sequences taken under different Bragg conditions and calculations of dynamic electron diffraction equations. J.M.

N71-23958# National Research Council of Canada, Ottawa (Ontario).
THE DEPENDENCE OF THE DISLOCATION DENSITY OF PURE AND Mg-DOPED LiF SINGLE CRYSTALS ON THE STRESS [DIE SPANNUNGSABHAENGIGKEIT DER VERSETZUNGSPICHTEREINER UND MG-DOTIERTER LIFEINKRISTALLE]
B. Reppich 1971 21 p refs Transl. into ENGLISH from Phys. Status Solidi (East Ger.), no. 35, 1969 p 339–351
(NRC-TT-1447) Avail: NTIS

High purity and Mg-doped (100)-oriented LiF single crystals with different thermal treatment were deformed in compression under constant load at room temperature. The relation between shear stress and dislocation density was investigated by means of the etch-pit technique. Inhomogeneities of the dislocation arrangement were taken into account in the evaluation. Etching under stress indicates that in strain hardened crystals the etch-pit density and arrangement are not changed visibly by unloading. The constant of dislocation interaction is obtained as alpha = 0.25 independent of Mg-doping level and heat treatment. Author

N71-24015# University of Southern Calif., Los Angeles.
NEW METHODS FOR GROWTH AND CHARACTERIZATION OF GaAs AND MIXED 3-5 SEMICONDUCTOR CRYSTALS Semiannual Technical Report, 1 Jul. 1970–1 Jan. 1971
William R. Wilcox 1 Jan. 1971 39 p refs
(Grant DAHC15-70-G-14; ARPA Order 1628)
(AD-718138; SATR-1) Avail: NTIS CSCL 20/12

A new technique for growing bulk gallium arsenide crystals has been invented and is being developed. Potentially this will enable production of III-V semiconductor crystals of higher quality than presently available. A new technique has been developed for drying encapsulating glasses, such as B2O3, for use in crystal growth. An improved polishing technique has been developed using sodium hypochlorite on a special polishing pad and a technique for producing reliable metal contacts on GaAs has been developed. An improved method has been developed for interpreting data on photoemission from Schottky barriers and gallium arsenide field effect transistors have been produced by liquid epitaxial growth techniques. Author (GRA)

N71-24137 National Lending Library for Science and Technology, Boston Spa (England).
ON THE THEORY OF THE ISOTHERMAL HALL EFFECT IN INTRINSIC SEMICONDUCTORS FOR A WEAK MAGNETIC FIELD
Winifred Klassmann [1971] 8 p refs Transl. into ENGLISH from Z. Physik (Berlin), v. 218 1969 p 237–244
(NLL-M-20331-(5824.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The usual simple theory of the Hall effect in the intrinsic semiconductor is amended. The condition of the local neutrality is abandoned and replaced by a global neutrality. Thereby a certain modification of the Hall-voltage formula results, which may not be neglected, for instance, in the case of semiconductors of low carrier density. There follows a determination of the form of the Hall field, particle current and charge density in the bulk semiconductor with explicit regard to both the surface and volume recombination. The dependence of the Hall field on the surface recombination is important, because of the decided influence which the surface recombination exerts on the processes in the semiconductor. The derived formulas are valid only for a weak magnetic field and contain those given by other authors as special cases. Author

N71-24303 Pennsylvania State Univ., University Park.
EFFECT OF HYDROSTATIC PRESSURE ON EXCESS CARRIER LIFETIMES IN GERMANIUM
Warren Jacob Ereslan (Ph.D. Thesis) 1969 80 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 70-7203

Measurement of the excess carrier lifetime as a function of temperature and pressure were made on n-type and p-type germanium. From the behavior of the lifetime under hydrostatic pressure, it was inferred that the level is associated with an

interstitial impurity. Low temperature data indicate that the electron and hole capture coefficients are independent of pressure. The 5 ohm-cm p-type sample contains a recombination level 0.13 ev from one of the band edges, and a trap level 0.03 ev from one of the band edges. Pressure measurements on the recombination level showed that it approaches the nearest band edge at a rate of 1.5 × 100,000 eV sq cm kg/1. Dissert. Abstr.

N71-24304 Lehigh Univ., Bethlehem, Pa.
THEORY OF TUNNELING IN MIS STRUCTURE WITH INTERFACE STATES
Leo Boyes Freeman, Jr. (Ph.D. Thesis) 1969 169 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 70-10596

The localized states at the semiconductor-insulator interface are represented by a distribution of delta function potentials, and their wave functions calculated. Following the method of Bardeen, the tunneling matrix element, and thus the tunneling current to these states is determined. The resulting equations are obtained by an extension of the Shockley-Read recombination theory and are solved for the case of an applied dc bias with a small superimposed ac signal, leading to the static current/voltage and dynamic admittance/voltage characteristics of the device. The model's characteristics are plotted for different device parameters. The dependence on interface state density and distribution, capture cross section, interface potential, semiconductor doping, insulator thickness, and ac frequency are calculated and graphically presented. Dissert. Abstr.

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N71-23171*# New York Univ., N.Y. School of Engineering and Science.
THE BOND STRESS IN A VISCOELASTIC PROPELLANT DISK DURING THERMAL SHOCK
Bernard W. Shaffer and Myron Levitsky Sep. 1970 32 p refs
(Grant NGL-33-016-067)
(NASA-CR-117891; S-70-6) Avail: NTIS CSCL 21I

The variation with time of the bond stress in a case bonded solid propellant rocket assembly is studied under conditions of plane stress, when the external temperature changes abruptly. Maxwell, Voigt, and four element models are assumed for the propellant, and effects arising from changes in viscoelastic properties, thermal expansion coefficients, and heat transfer characteristics of the assembly are studied. It is found that the bond stress equations are separable into a stress factor identical to the solution of the equivalent elastic problem, and a time dependent factor, which is a function of the viscoelastic constants. Quantitative aspects of the solution are presented in dimensionless form. Author

N71-23438# Air Force Systems Command, Wright-Patterson AFB, Ohio. Air Force Aero Propulsion Lab.
EVALUATION OF THE AQUA-GLO SERIES 2 FREE WATER DETECTOR Summary Report
Charles R. Martel Nov. 1970 74 p refs
(AD-718418; AFAPL-TR-70-63) Avail: NTIS CSCL 14/2

The Aqua-Glo Series II free water detector, for use in measuring the quantity of free (undissolved) water in hydrocarbon fuels, was evaluated. Two dynamic test loops and a batch-blending calibration apparatus were used to check the accuracy and repeatability of the Aqua-Glo Series II. The Aqua-Glos response to free water in fuel was found to be affected by the presence of fuel additives in the fuel and by the degree to which the water was dispersed in the fuel. Corrosion inhibitors such as Santolene C, AFA-1, and Lubrizol 541 were found to decrease the Aqua-Glos response to free water while the fuel system icing inhibitor was found to increase the Aqua-Glos response to free water. A poor dispersion of the free water in fuel, i.e., one that has a few large drops versus a good dispersion, where there are many small drops, resulted in decreased repeatability and a lowered Aqua-Glo response. In general, the Aqua-Glo Series II free water detector was found to be suitable for field use in its present configuration over the range of 2 to 40 milligrams per liter of water in the fuel. Author (GRA)

N71-23450# Institut fuer Chemie der Treibstoffe, Berghausen (West Germany).
SAFETY DISTANCE FOR STORAGE AND HANDLING OF EXPLOSIVES [SICHERHEITSABSTAENDE BEI DER LAGERUNG UND HANDHABUNG EXPLOSIONSFAEHIGER STOFFE]
W. Diepold, H. Pfoertner, and H. Hommel 20 Mar. 1970 46 p refs In GERMAN
(ICT-1/70) Avail: NTIS

Experimental data are compared to official specifications for the handling and storage of explosives. In particular, the damping of explosion effects is discussed. A distance formula differentiated for four distance ranges is presented. ESRO

N71-23514# Institut fuer Chemie der Treibstoffe, Berghausen (West Germany).
DILATOMETRIC INVESTIGATIONS OF AMMONIUM NITRATE [DILATOMETRISCHE UNTERSUCHUNGEN AN PHASENSTABILISIERTEM AMMONIUMNITRAT]
W. Engel 31 Dec. 1969 35 p refs In GERMAN
(ICT-8/69) Avail: NTIS

A volumetric method was developed to measure dilatation of ammonium nitrate with additions of nickel or copper compounds for stabilization purposes during phase transformations. The design of the dilatometer is described which uses mercury as a measuring liquid. The results are evaluated by a FORTRAN program. ESRO

N71-23533# Explosives Research and Development Establishment, Waltham Abbey (England).
TENSILE PROPERTIES OF PLASTIC PROPELLANTS RD2435, E3342, and E4058
R. W. Bryant, W. A. Dukes, and R. A. Gledhill May 1970 29 p refs
(ERDE-TN-13) Avail: NTIS

The Williams-Landel-Ferry technique has been applied to the uniaxial tensile property data for RD2435/Lot 9, E3342/Lot 9A and E4058/Lot 1. The derived glass transition temperatures are −85, −80, and −75 C respectively. Over the temperature range from +60 to −40 C, the mean effective gauge length of ERDE dumb-bells of all seven plastic propellants so far examined is 56 + or −2.5 mm. At −60 C and below, the effective gauge length increases with increasing strain rate. There is little difference between the extensibilities of RD2435, E3342, and E4058 at a given stress level. It is concluded that the variations in proportions of ingredients in the plastic propellant compositions so far examined are insufficient to have appreciable effect on their failure loci. Author (ESRO)

N71-23617# Utah Univ., Salt Lake City. Dept. of Chemical Engineering.
COMBUSTION IRREGULARITIES OF SOLID PROPELLANTS Final Summary Report
Norman W. Ryan 17 Apr. 1970 12 p
(Grants AF-AFOSR-446-66; AF-AFOSR-446-67)
(AD-718057; AFOSR-70-1176TR) Avail: NTIS CSCL 21/9

A brief summary statement is given of recent progress and final status of four projects concerned with research on

combustion instability of solid propellants: L* instability, gas-fired T-burner, radial-mode oscillator and feedback flux-regression rate coupling. Descriptive results only are given, details being presented in four scientific reports to be issued shortly. Author (GRA)

N71-23618# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Lampoldshausen (West Germany). Inst. fuer Chemische Raketenantriebe.
APPROXIMATE FUNCTIONS FOR THEORETICAL PERFORMANCE PARAMETERS OF HIGH-ENERGY ROCKET PROPELLANT COMBINATIONS [NAEHERUNGSFUNKTIONEN FUER THEORETISCHE LEISTUNGSDATEN HOCHENERGETISCHER RAKETENTREIBSTOFFKOMBINATIONEN]
Hans J. Sternfeld and Josef Reinkenhof Dec. 1970 104 p refs In GERMAN; ENGLISH summary
(DLR-FB-70-77) Avail: NTIS; ZLDI Munich: 28,10 DM

Approximate functions in two variables are presented for theoretical performance parameters of the high-energy rocket propellant combinations liquid oxygen/gaseous hydrogen, liquid fluorine/liquid ammonia, and liquid fluorine/liquid hydrazine. The parameters included are characteristic velocity, specific impulse, and combustion chamber temperature for both equilibrium and frozen composition during expansion. The approximate functions are valid for wide ranges of mixture ratios and chamber pressures from 4 to 20 bar. Deviations between approximate and exact data are determined. The approximate methods used are described. Author (ESRO)

N71-23805# Air Force Systems Command, Wright-Patterson AFB, Ohio. Aero Propulsion Lab.
EFFECTS OF FUEL SLOSH AND VIBRATION ON THE FLAMMABILITY HAZARDS OF HYDROCARBON TURBINE FUELS WITHIN AIRCRAFT FUEL TANKS Technical Report, 1 Sep. 1969 – 30 Apr. 1970
Edwin E. Ott Nov. 1970 63 p refs
(AD-718091; AFAPL-TR-70-65) Avail: NTIS CSCL 21/2

The report deals with the effects of liquid fuel motion on the flammability of hydrocarbon turbine fuels in aircraft fuel tanks. Three military turbine fuels, JP-4, JP-5, and JP-8, were used in the testing. The fuels were placed in an explosion proof cylindrical test vessel (80-gallon capacity) and subjected to slosh and vibration. An electric arc was formed within the ullage which ignited any flammable fuel-air mixture present. The pressure rise from combustion was measured and correlated with initial conditions. The major effect of fuel slosh and vibration was to lower or abolish the lean flammable temperature limit of the fuel. The rich flammable temperature limit was unchanged. An analysis was performed on these results and an explanation proposed based upon the hypothesis that all the fuel vapor in the ullage burns for combustion below the flash point. Author (GRA)

N71-24063*# Scientific Translation Service, Santa Barbara, Calif.
PREVAPORIZATION OF LIQUID FUEL IN A SMALL RAMJET ENGINE [DIE VORVERDAMPFUNG VON FLOSSIGKRAFTSTOFF IN EINEM KLEINEN STAUSTRAHLTRIEBWERK]
F. Gehring (Ph.D. Thesis – Stuttgart Univ.) Washington NASA Apr. 1971 128 p refs Transl. into ENGLISH from Deut. Luft- und Raumfahrt, German report DLR-FB-69-67
(Contract NASw-2035)
(NASA-TT-F-13805) Avail: NTIS CSCL 21E

In order to improve the combustion efficiency the liquid fuel is heated up by the dissipated heat of the ramjet engine to such an extent that it evaporates immediately during expansion in the injection system. The application and functional reliability of this fuel preevaporation system in small tip drive ramjet engines is demonstrated and proved by means of tests. The influence of the operational parameters, such as velocity of air flow, altitude, air-fuel ratio, fuel flow rate and pressure on the caloric state of the fuel before injection and after expansion was theoretically investigated. Author

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magneto-hydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N71-23113*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
LIFE TEST, 8000-HOUR, OF AN ELECTRON BOMBARDMENT MERCURY ION THRUSTER SYSTEM FOR SERT 2 Final Report
H. F. McKinney, J. L. McDaniels, and R. A. Dutton 20 Nov. 1970 132 p refs
(Contract NAS3-11521)
(NASA-CR-72789) Avail: NTIS CSCL 21C

The operational performance of an electron bombardment mercury ion thruster system was monitored during approximately 8000 hours of life testing in a space simulation chamber. The thruster system consisted of a NASA flight-type 15-cm Kaufman thruster and power conditioning unit. The thruster system and space simulation facility achieved nearly a year of operation without removal of the system from the simulated space environment. The test was completed when the thruster propellant supply was exhausted. Author

N71-23293* Electro-Optical Systems, Inc., Pasadena.
ION ENGINE CASING CONSTRUCTION AND METHOD OF MAKING SAME Patent
Gordon Sohl, inventor (to NASA) Issued 26 Nov. 1968 (Filed 6 Jul. 1966) 8 p Cl. 60-202 Sponsored by NASA
(NASA-Case-XNP-06942; US-Patent-3,412,559; US-Patent-Appl-SN-563651) Avail: US Patent Office CSCL 21C

An electron bombardment-ion engine casing is described for use in spacecraft propulsion systems on long term missions. The outer casing is permanently magnetized to generate the magnetic field used to control the bombarding electrons which reduces the structural weight of the ion engine. Techniques used in construction of the permanently magnetized outer casing are outlined. J.M.

N71-23707# Southampton Univ. (England). Dept. of Electrical Engineering.
FUNDAMENTAL PHENOMENA OF THE COLLOID THRUSTER Annual Report, 1 Jun. 1969 – 31 May 1970
T. Erin, B. Mekin, D. J. Lines, and A. W. Bright Paris ESRO Nov. 1970 33 p refs
(Contract ESTEC-702-69-AA)
(ESRO-CR-22) Avail: NTIS

An experimental investigation of slit-type colloid thrustors and their propellant liquids was begun. A slit geometry was developed that operated well in a low charge-to-mass-ratio mode in which steady operation of 10 C/kg was achieved. It is hoped that this can be extended to a high charge-to-mass-ratio mode by transition from an external meniscus to an internal meniscus. An electrochemical study of the spraying process showed that an aprotic liquid would be a good replacement for the usual propellant solution of NaI in glycerol, and would possibly have the advantage of bipolar operation. Tests with a solution of 9,10,-diphenyl anthracine in glycerol achieved a charge-to-mass-ratio of 2000, which is in the range normally accepted for operation of a colloid thruster. Author (ESRO)

N71-23761*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PROSPECTS FOR A MULTIPURPOSE SOLAR ELECTRIC PROPULSION STAGE
E. A. Willis, Jr., F. J. Hrach, W. C. Strack, and C. L. Zola Mar. 1971 50 p refs
(NASA-TM-X-67801) Avail: NTIS CSCL 21C

A review of current solar-electric propulsion (SEP) technology is given along with preliminary performance estimates for a fixed design multipurpose SEP stage or "bus" over a broad spectrum of missions and two launch vehicles. Results for an arbitrarily chosen 10 kilowatt, 2600 second specific impulse design show that a single SEP vehicle would have excellent performance capability. Its performance margin over a TE 364-4 chemical stage is especially great for the more difficult missions. No technical problems are apparent that might preclude the successful demonstration of flight-rated hardware by the latter 1970's. Author

N71-23762*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYTIC PERFORMANCE OF TWO GRID ACCELERATOR DESIGNS FOR KAUFMAN THRUSTERS
Walter C. Lathem Washington Apr. 1971 27 p refs
(NASA-TN-D-6275; E-6032) Avail: NTIS CSCL 21C

Results are presented for a theoretical analysis of the performance of two-grid accelerator systems for Kaufman thrusters. Six configurations were used to cover the range of geometries which are of immediate interest. A digital computer program was used to find axially symetric solutions for a single hole of each configuration. Results are presented in terms of maximum current per hole, thrust per hole (including beam divergence effects), and maximum net- to total-voltage ratio consistent with the prevention of electron backstreaming. The results presented should be used in the design of accelerator systems for a variety of applications. An analysis of the effects of charge-exchange ions on the erosion rate of the accelerator grid resulted in equations which could be used to predict the expected useful lifetime of the grid. The equations seemed consistent when theoretical results were compared with experimental results for the SERT II configuration. However, when applied to the configurations used in this analysis, limitations in the usefulness of the model were found and are presented herein. Author

N71-23764*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SHUTTLE AIRBREATHING PROPULSION
Warner L. Stewart, Arthur J. Glassman, and Stanley M. Nosek [1971] 15 p Presented at the 7th Propulsion Joint Specialist Conf., Salt Lake City, 14–18 Jun. 1971; sponsored by AIAA
(NASA-TM-X-67806) Avail: NTIS CSCL 21A

Airbreathing gas turbine engines are considered to provide cruise, landing, go-around, and ferry capability for space shuttle vehicles. The study reported is based on the necessity to determine which engines are most suitable and to examine them for modifications and technology needed to meet new requirements such as launch, space residence, and reentry. A review is made of the requirements imposed on the engine, the effect of fuel selection, and the studies currently being conducted to assess candidate engine designs. Author

N71-23821*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FEASIBILITY STUDIES ON AN AUXILIARY PROPULSION SYSTEM USING MPD THRUSTERS
James A. Burkhart and George R. Seikel [1971] 13 p refs Presented at 7th Propulsion Joint Specialist Conf., Salt Lake City, 14–18 Jun. 1971; sponsored by AIAA
(NASA-TM-X-67805) Avail: NTIS CSCL 21C

A low-power MPD thruster with a downstream cathode has previously demonstrated a thrust efficiency adequate for use in auxiliary propulsion systems. Other desirable features for such an application were therefore explored. Thrust vectoring with a skewed coil arrangement was found to be feasible. Operation with a single power supply was also demonstrated. For this the magnets were placed in series with the discharge and a small transistorized starting circuit was placed between the discharge anode and cathode. The use of rechargeable batteries to power a low-duty cycle thruster and the storage of xenon propellant as a superfluid in lightweight tanks was also studied. Author

N71-23924*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MATHEMATICAL REPRESENTATION OF CURRENT DENSITY PROFILES FROM ION THRUSTERS
Thaine W. Reynolds Washington Apr. 1971 25 p refs
(NASA-TN-D-6334; E-6103) Avail: NTIS CSCL 21C

A concise and convenient way of expressing ion beam spreading characteristics is presented. A two-parameter equation is shown to be capable of representing the ion beam current density profiles from several bombardment ion thrusters. Use of such an expression permits analytical treatment of beam interaction phenomena such as thrust loss due to beam spreading and sputtering erosion. Author

N71-23925*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ANNULAR SLIT COLLOID THRUSTER RESEARCH AND DEVELOPMENT
Kenneth W. Stark and William A. Burton Washington May 1971 59 p refs
(NASA-TN-D-7001; G-1002) Avail: NTIS CSCL 21C

Research in the optimization of performance, and performance characteristics of the annular slit colloid thruster is presented. Numerous tests were conducted with thrusters having nominal diameters of 0.080 in. and 0.76 in. The phenomenon of glow spray was encountered. Reduced flow rates and various propellant combinations were tested as possible ways to eliminate glow spray. Based on the results, the use of sodium iodide and 1,2,6-hexanetriol as a propellant offers significant advantages over the use of sodium iodide and glycerol. An improvement in performance was noted with both propellants when flow rates were reduced; however, over extended periods of operation, there are indications that electron back bombardment degrades performance. An important factor in the success of the colloid R&D program is the reduction or elimination of the effects of electron back bombardment. Author

N71-23927*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INSTANTANEOUS AND DYNAMIC ANALYSIS OF SUPERSONIC INLET-ENGINE COMPATIBILITY
James E. Calogeras, Paul L. Burstadt, and Robert E. Coltrin [1971] 16 p refs Presented at the 7th Propulsion Joint Specialist Conf., Salt Lake City, 14–18 Jun. 1971; sponsored by AIAA
(NASA-TM-X-67821) Avail: NTIS CSCL 21A

An experimental wind-tunnel investigation was made to determine the effects of time-variant distortions produced in a supersonic inlet on a J85-GE-13 turbojet engine. Results are presented principally in terms of instantaneous distortion amplitudes and contours measured through compressor stall. They indicate that although a time-averaged distortion may be far from a stall-inducing value, corresponding instantaneous distortion amplitudes can approach or exceed this value. A film made by combining instantaneous distortion contours demonstrates that severe total pressure fluctuations at the compressor face can result in an instantaneous distortion of a type completely different from the time-averaged distortion. Author

N71-23955*# Martin Marietta Corp., Denver, Colo.
RESUPPLY/REPAIR OF SOLID OR HYBRID ATTITUDE PROPULSION SUBSYSTEMS. VOLUME 1: PROGRAM SUMMARY Final Report, 1 Jul. – 31 Dec. 1970
J. Michael Murphy Apr. 1971 47 p refs
(Contract NAS8-26196)
(NASA-CR-103111; MCR-71-11-Vol-1) Avail: NTIS CSCL 21H

The results are summarized of a study to determine optimum methods for orbital resupply, maintenance, and repair of a hybrid attitude propulsion subsystem (APS) for a large orbiting space station. It is concluded that the hybrid rocket is an attractive candidate for the space station APS because the use of a solid fuel and a liquid oxidizer removes the failure modes associated with mixing propellants together at the wrong time, in the wrong place, or in the wrong quantity. The selected propellants are completely nontoxic and nonhypergolic. This propulsion approach is the safest of those considered. In addition, the hybrid combustion process is insensitive to grain imperfections and chamber pressure variations which minimizes the propellant logistics because of its commonality with other space station subsystems. The hybrid APS combines the simplicity of a monopropellant engine with the performance of a bipropellant engine with the performance of a bipropellant engine. Author

N71-23968* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMBUSTION CHAMBER Patent
John W. Gregory, inventor (to NASA) Issued 12 Aug. 1969 (Filed 7 Mar. 1967) 4 p Cl. 239-127.1; Int. Cl. B64d33/04
(NASA-Case-XLE-04857; US-Patent-3,460,759;
US-Patent-Appl-SN-621742) Avail: US Patent Office CSCL 21H

A regenerative cooling system for rocket combustion chambers is described which is designed to: (1) reduce the time and expense of fabrication, (2) increase the operational life of the combustion chamber, and (3) reduce the heat flux to the coolant. The system consists of a downstream convergent-divergent throat with a number of regenerative coolant tubes, of constant cross section, positioned longitudinally between the inner and outer walls. A powdered ceramic heat barrier encases the tubes and heat dispensing fins are fastened to the tubes at the combustion chamber section. The inner throat wall is made of a high temperature refractory metal and the coolant tubes are formed of stainless steel. D.L.G.

N71-23980*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COLD AIR INVESTIGATION OF A TURBINE WITH TRANSPIRATION COOLED STATOR BLADES 4: STAGE PERFORMANCE WITH WIRE-MESH SHELL STATOR BLADING
Frank P. Behning, Harold J. Schum, and Edward M. Szanca Washington Apr. 1971 30 p refs
(NASA-TM-X-2176; E-6028) Avail: NTIS CSCL 21E

Turbine performance characteristics were obtained with a single-stage axial-flow turbine which had stator blades employing transpiration coolant ejection through a wire-mesh shell. The turbine was tested over a range of speed and pressure ratio and with nominal coolant fraction of 0.031. Additional tests were made at the design speed, in which the coolant flow was varied from 0 to 0.07 of the primary flow. The results were compared to similar results obtained from turbines using stator trailing-edge coolant ejection and discrete hole transpiration-cooled stator. A base turbine with no cooling provisions was used as a standard for comparisons. Author

N71-24009*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LOW SPEED JET NOISE FROM A 1.83 METER (6 FOOT) FAN FOR TURBOFAN ENGINES
Gene L. Minner and Charles E. Feiler [1971] 11 p refs Presented at the 4th Fluid and Plasma Dyn. Conf., Palo Alto, Calif., 21 – 23 Jun. 1971 Sponsored by AIAA
(NASA-TM-X-67825) Avail: NTIS CSCL 21E

The jet noise contribution to the far field sound from a 1.83 meter diameter fan has been determined for two simulated nacelle configurations. One nacelle had hard walls, while the other has acoustic liners on the wall and on inlet splitter rings. The jet velocities, typical of high bypass ratio fan engines, varied from 137 to 223 meters per second. The results of the study show that the acoustic liners effectively eliminate low frequency noise from internal sources. Data from the lined configurations were found to be in good agreement with the eighth power dependence on jet velocity. Data from the hard wall configurations, because of the influence of internally generated noise, show higher noise levels and a weaker velocity dependence. Author

N71-24321* Aerojet-General Corp., El Monte, Calif.
SWIRLING FLOW NOZZLE Patent
Frank X. McKevitt, inventor (to NASA) Issued 13 May 1969 (Filed 17 May 1967) 4 p Cl. 60-263; Int. Cl. F02k1/02, 9/00, Int. Cl. B05b3/00 Sponsored by NASA
(NASA-Case-XNP-03692; US-Patent-3,443,384;
US-Patent-Appl-SN-640787) Avail: US Patent Office CSCL 21H

A method and construction for increasing the efficiency of a rocket engine by matching its exhaust gas pressure with changing ambient pressure is discussed. A gas is introduced tangentially into the engine so as to form a vortex within the nozzle. The size of the vortex can be used to vary the effective throat area of the nozzle. The size of the vortex can be changed by varying the relative amounts of axial and/or tangential flow of gases to the nozzle. Official Gazette of the U.S. Patent Office

N71-24322*# Aeronautical Research Labs., Melborune (Australia).
A 100 HOUR TEST OF CHROMIUM ALLOY BLADES IN A RIG TURBINE
A. S. Finlay Oct. 1970 12 p refs
(ARL/ME-320) Avail: NTIS

A test of 140 hours total duration, in 29 starts, has been made of a turbine wheel fully bladed with uncooled chromium alloy blades. 100 hours of this test were at an inlet gas temperature of 1200 C; average permanent creep extension of the blades was 0.0009 inches. Author

N71-24348*# Sandia Corp., Albuquerque, N.Mex.
FUNCTIONAL TEST OF A ROCKET ENGINE MODULE (REM)
John H. Morgan and Lawrence C. Bennett Oct. 1970 20 p Sponsored by AEC
(SC-DR-70-911) Avail: NTIS CSCL 21H

The procedure and equipment used in a rocket engine module functional test under a controlled spin and torque profile environment are discussed. Author

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N71-23112*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
ASYMMETRIC ACCESS OF ENERGETIC SOLAR PROTONS TO THE EARTH'S NORTH AND SOUTH POLAR CAPS
J. A. Van Allen, J. F. Fennell, and N. F. Ness (NASA. Goddard Space Flight Center) Dec. 1970 39 p refs
(Contracts NAS5-9076; NAS5-10815; NAS1-2973; NAS1-8141; N00014-68-A-0196-0003)
(NASA-CR-117889; Rept-70-63) Avail: NTIS CSCL 03B

During the energetic solar particle event that began on January 24, 1969, the ratio N/S of the intensity of protons E sub p > 0.3 MeV over the earth's north (N) polar cap (Lambda > 80 deg) to that over its south (S) polar cap (− Lambda > 80 deg) varied from a value greater than 20 to about 1, as observed with satellite Injun 5 in a low altitude polar orbit. The interplanetary intensity of protons was measured simultaneously with similar detectors on Explorer 33 and Explorer 35 in two nearly-orthogonal planes and in eight different directions on the unit sphere (some overlap). High values of the N/S ratio early in the event corresponded to an extraordinarily strong anisotropy of intensity in interplanetary space with the anisotropy vector pointing dominantly southward. The N/S ratio dropped toward 1 as the interplanetary beam relaxed toward isotropy. Similar, though less well determined, findings applied to protons E sub p > 3.4 MeV and alpha particles E sub alpha > 1.18 MeV. Author

N71-23204*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ADVANCED ENGINEERING
In its The Deep Space Network, Vol. 2 15 Apr. 1971 p 42–121 refs (See N71-23201 12-11)
Avail: NTIS CSCL 03B

Advanced engineering research and development progress is reported on : (1) second order charged particle effects on electromagnetic waves in interplanetary medium (2) hardware version of an optimal convolutional decoder; (3) improved frequency dividers; (4) limits of minimum distance decoding; (5) symmetrically decodable codes; (6) Boolean difference calculus and fault finding; (7) developments in hydrogen maser frequency standard; (8) sequential ranging with Viterbi algorithm; (9) microwave transmission through perforated flat plates; (10) hydrogen maser cavity tuning servo design; (11) improved RF calibration techniques; (12) photon energies of CRT system; (13) Mark 3A Simulation Center interactive alphanumeric television system; (14) reanalysis program for antenna member size changes; and (15) antenna structures. A.L.

N71-23262# Lockheed Missiles and Space Co., Palo Alto, Calif.
GAMMA RAY INVESTIGATION ON THE KOSMOS-135
R. L. Aptekar et al 1970 8 p refs Transl. into ENGLISH from Kosm. Issled. (USSR), v. 8, no. 6, 1970 p 923–930
Avail: NTIS; National Translations Center, John Crerar Library, Chciago, Ill. 60616

Space and time distributions of the intensity and spectrum composition of gamma radiation in the 0.3 to 2.7 MeV energy range were measured on the Cosmos 135 by using a multichannel scintillation gamma spectrometer. Accompanying measurements of the phonon effects due to secondary radiation, which originates in the satellite material and in the detector itself under the effect of cosmic rays and trapped radiation, were studied. Dependences on the geomagnetic threshold stiffness were obtained for the values of the gamma radiation flux with 0.511 MeV energy, and the flux of charged particles. The flux of gamma quanta of extraterrestrial origin was determined to be 0.35 + or − 0.15/sq cm-sec. Author

N71-23263# Chicago Univ., Ill. Enrico Fermi Inst.
COSMIC AND SOLAR RADIATION STUDIES AND THEIR ASTROPHYSICAL CONSEQUENCES Final Report
J. A. Simpson 11 Nov. 1970 48 p refs
(Contract AF 49(638)-1642)
(AD-717891; AFOSR-70-2723TR) Avail: NTIS CSCL 3/2

The final technical report contains the list of 33 published papers and papers in press for which the research was supported in whole or in part by the contract. The document also reports on the relationship of these published papers to topic areas of scientific research sponsored by the contract (such as chemical and isotopic composition of galactic cosmic rays, solar modulation, solar acceleration, magnetospheric physics). GRA

N71-23323# California Univ., Berkeley. Dept. of Physics.
UCSD COSMIC RAY MUON ZENITH ANGLE EXPERIMENT Final Report
George E. Masek 13 Oct. 1970 18 p refs
(Grant AF-AFOSR-1741-69)
(AD-718439; AFOSR-70-2558TR) Avail: NTIS CSCL 4/1

Recent investigations into the zenith angle dependence of very high energy (E > 1000 GeV) cosmic ray muons have shown a discrepancy from what would be expected if the muons originate from pions and kaons, as is currently believed to be the case. If this discrepancy is confirmed it could have important implications concerning possibly a new particle or new process. During the past year and a half the author has designed and constructed a large cosmic ray telescope to measure the zenith angle distribution of muons up to 6000 GeV. The apparatus is capable of observing 10 events a day with E > 1000 GeV and should be able to substantiate the above effect with about 9 months of running time. Author (GRA)

N71-23433*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CURRENT SHEET MAGNETIC MODEL FOR THE SOLAR CORONA
Kenneth H. Schatten Mar. 1971 29 p refs Submitted for publication
(NASA-TM-X-65496; X-692-71-132) Avail: NTIS CSCL 03B

A new magnetic model is developed and compared with previous models and the observed solar corona. An attempt is made to more accurately compute the three dimensional currents flowing in the solar corona. Physical reasons are given that require most of the large-scale currents flowing in the solar corona to lie near thin sheets. The current sheets are not constrained into any particular geometry or symmetry as in the previous models of Altschuler and Newkirk (1969) and Schatten et al (1969). A comparison with the axisymmetric, isothermal MHD solution of Pneuman and Kopp (1970) suggests that the model is able to simulate to high accuracy an isothermal corona. A comparison of the model with the May 30, 1965 solar eclipse and the November 12, 1966 solar eclipse shows the model is capable of computing many features including the polar plume orientations as well as radial and non-radial streamers in the solar corona. Author

N71-23434*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EXPERIMENT TO MEASURE HARD SOLAR AND CELESTIAL X-RAYS FROM THE FIFTH ORBITING SOLAR OBSERVATORY
K. J. Frost, B. R. Dennis, and R. J. Lencho Dec. 1970 15 p ref
(NASA-TM-X-65504; X-680-70-440) Avail: NTIS CSCL 04A

An experiment is described designed to measure solar and celestial x-rays in the energy range between 15 to 250 keV. The objectives for measuring solar x-rays consist of: (1) measuring the spectrum of solar x-ray bursts as a function of time throughout the duration of the bursts; and (2) conducting a search for a weak, constantly present and/or activity-dependent component of solar x-rays in the 15 to 250 keV range for successive solar rotations during the lifetime of the spacecraft. The objectives in measuring celestial x-rays include: (1) measuring the intensity, spectrum and spatial distribution of diffuse celestial x-rays; and (2) measuring the intensity, spectrum and possible temporal variations of those point sources that can be isolated with the rather broad field of view (40 deg FWHM) of the detector. Author

N71-23448*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EVIDENCE FOR MULTIPLE PERIODICITY IN THE X-RAY EMISSION FROM Cyg X-1
S. S. Holt, E. A. Boldt, D. A. Schwartz, P. J. Serlemitsos, and R.

D. Bleach (Md. Univ.) Mar. 1971 12 p refs Submitted for publication
(NASA-TM-X-65494; X-661-71-127) Avail: NTIS CSCL 03B

X-ray data from a rocket-borne exposure to Cyg X-1 confirm indications of periodicity. However, the data are inconsistent with a single periodic component at 73 msec, and are most easily reconciled in terms of at least two harmonic components at lower frequencies. Author

N71-23493*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HARD X-RAY EVIDENCE FOR TWO STAGE PARTICLE ACCELERATION IN A SOLAR FLARE
K. J. Frost and B. R. Dennis Nov. 1970 13 p refs Submitted for publication
(NASA-TM-X-65503; X-680-70-439) Avail: NTIS CSCL 03B

A solar X-ray burst which evolves in time through two non-thermal phases is presented. The burst is considered to be bremsstrahlung from electrons accelerated in two stages in the solar atmosphere. In the first stage acceleration effectively to 100 keV occurs, perhaps by an induced electric field; in the second stage the acceleration to higher energies could occur by a Fermi mechanism operating in a shock front. Author

N71-23763# Naval Research Lab., Washington, D.C.
ON THE PHOTO-INDUCED BETA DECAY OF PROTONS AND NEUTRONS IN STELLAR INTERIORS
John N. Hayes 6 Jan. 1971 29 p refs
(AD-718320; NRL-7124) Avail: NTIS CSCL 3/2

In this first phase of a study on photon-induced beta decay, the reaction rate for gamma + p yields n + Positron + Nu sub e is determined for conditions approximating those in stellar interiors. It is shown that the lifetime of the proton in such conditions drops from infinity to only microseconds as the temperature varies from 0 to 10 to the 12th power degrees K. Hence the stability of the proton against this reaction is not seriously altered and will not affect nucleosynthesis (which depends on the availability of protons). However, the reactions gamma + n yields p + electron + Nu sub e bar and electron + p yields n + Nu sub e are not restrained by threshold energy requirements. If the neutrons lifetime is drastically reduced by this latter reaction to the point that it cannot live long enough to react with nuclei, then nucleosynthesis in stars will be curtailed at very high temperatures. Attempts in this latter case to proceed with calculations along the same line as the gamma + p calculation run immediately into a divergence problem, as is shown here. The correct handling of this reaction will be the subject of another report when completed. Author (GRA)

N71-23893 New Mexico Univ., Albuquerque.
COSMIC RAY ANISOTROPY IN INTERPLANETARY SPACE
Jacqueline Hope Ericksen (Ph.D. Thesis) 1969 160 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 70-10117

The solar diurnal variation of cosmic ray intensity results from an interaction of cosmic rays with the corotating spiral interplanetary magnetic field. Changing interplanetary conditions might therefore be reflected in the diurnal variation. It is found that the solar diurnal variation monitored by underground telescopes is sensitive to the interplanetary sector structure, displaying a dependence of phase on the sense of the interplanetary magnetic field (predominantly into, or out of, the sun). It is shown that this phase dependence can arise from a cosmic ray anisotropy which is normal to the ecliptic plane, and that it is possible that the observed sector structure dependence of the solar diurnal variation and sidereal diurnal variations arise from the same source. In conclusion, the importance of underground measurement is emphasized. Dissert. Abstr.

N71-23894*# Translation Consultants, Ltd., Arlington, Va.
SOLAR CORPUSCULAR STREAMS AND THE GENERAL ATMOSPHERIC CIRCULATION OF THE EARTH [SOLNECHNYYE KORPUSKULYARNYYE POTOKI I OBSHCHAYA TSIRKULYATSIYA ZEMNOY ATMOSFERY]
E. R. Mustel Washington NASA Apr. 1971 6 p refs Transl. into ENGLISH from Russian Acad. of Sci. report, Astron. Tsirkulyar. No. 530, 15 Oct. 1969 p 1–5
(Contract NASw-2038)
(NASA-TT-F-13625) Avail: NTIS CSCL 03B

The intrusion of solar corpuscles is shown to lead to a change in the type of atmospheric circulation or to the intensification of an already existing one, and that the season of the year is the governing factor, despite the fact that only the winter period is considered. Author

N71-24008*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PHOTOCHEMISTRY AND LIFETIME OF INTERSTELLAR MOLECULES
L. J. Stief, B. Donn, S. Glicker, E. P. Gentieu, and J. E. Mentall Apr. 1971 28 p refs Submitted for publication
(NASA-TM-X-65495; X-691-71-128) Avail: NTIS CSCL 03B

A quantitative discussion is presented of the photochemistry and lifetimes of stable interstellar molecules detected by radio astronomy. For an interstellar molecule the lifetime against photodecomposition depends upon three factors: the absorption cross section, quantum yield or probability for dissociation following absorption, and the interstellar radiation field. These three elements are discussed along with a method for calculating the lifetimes. Various aspects of the results are briefly discussed. Author

N71-24168*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
REVERSE AND FORWARD SLOW SHOCKS IN THE SOLAR WIND
L. F. Burlaga and J. K. Chao (MIT, Cambridge, Mass.) Mar. 1971 26 p refs
(NASA-TM-X-65489; X-692-71-66) Avail: NTIS CSCL 03B

A reverse slow shock and a forward slow shock were found in plasma and magnetic field data from Pioneer 6. The shocks were oblique and weak (Mach ≈ 1.2). Numerous nonshock-like discontinuities were found with B sub 1 ≠ B sub 2 and N sub 1 ≠ N sub 2. Assuming pressure balance across them, an average electron temperature T sub e = (1.8 + or − .2)×100,000K was obtained. It was observed that discontinuities with B sub 1 + or − B sub 2, n sub 1 = N sub 2 seldom if ever occur. Author

N71-24182# RAND Corp., Santa Monica, Calif.
SUNSPOT THEORY BASED ON MAGNETO-FLUID-MECHANIC TURBULENT DAMPING
P. S. Lykoudis (Purdue Univ.) Jan. 1971 42 p refs
(Grant NSF GK-181)
(P-4567) Avail: Issuing Activity

Experimental and theoretical information are used to investigate the influence of a magnetic field on the mixing length and to solve the photospheric equations for sunspots of different effective temperatures. The following results are obtained: (a) The variation of the magnetic field intensity versus sunspot effective temperature is found in good agreement with observations. (b) An upper limit is established for the intensity of the magnetic field for which a sunspot can exist (about 3000 Gauss). (c) There is a lower limit for the effective temperature of a sunspot corresponding to the maximum magnetic field (about 3000 K). (d) The model yields the correct order of magnitude for the Wilson depression (about 400 km). Author

N71-24215 National Lending Library for Science and Technology, Boston Spa (England).
VARIATION OF PRESSURE AT THE EARTH'S SURFACE

DURING INTRUSIONS OF HIGH ENERGY PARTICLES
T. I. Sculka 1970 16 p refs Translated into ENGLISH from Arkt. Antarkt. Nauch. Issled. Inst. T. 289 (Leningrad), 1969 p 74–89
(NLL-M-20098-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Changes in pressure at the earth's surface during intrusion of streams of corpuscular radiation were studied for periods of polar cap and auroral absorption. Significant pressure minima were observed in two regions: the North Atlantic and Canada. It was found that the pressure changes over Canada due to the intrusion averages 5 to 6 mb, and sometimes exceeds 30 mb. F.O.S.

N71-24229 National Lending Library for Science and Technology, Boston Spa (England).
MAGNETIC FIELDS NEAR THE SUN
16 Feb. 1971 4 p Transl. into ENGLISH from Pravda (Moscow), 15 Jul. 1970
(NLL-M-20309-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The presence of magnetic fields was determined by the dispersion of radio waves indicating heterogeneous formations of the size of hundreds of km. The heterogeneous formations can exist only at stable magnetic fields. N.E.N.

N71-24259*# South Carolina Univ., Columbia.
INFRARED SPECTRA OF MOLECULES AND MATERIALS OF ASTROPHYSICAL INTEREST Quarterly Progress Report, 15 Dec. 1970 – 15 Mar. 1971
James R. Durig Mar. 1971 39 p refs
(Grant NGR-41-002-003)
(NASA-CR-117888) Avail: NTIS CSCL 03B

Vibrational spectra from 4000 to 33 per cm of molecules that are expected to occur in the Jovian atmosphere were studied to provide vibrational frequencies for determining the cloud cover of planets. The work on azomethane and azomethane-d sub 6 is reported with the far infrared spectrum analysis of 1-pyrazoline. A detailed examination of the infrared and Raman spectra of CH3NNCH3 and CD2NNCD3 is also presented. F.O.S.

N71-24262# Max-Planck-Institut fur Aeronomie, Lindau uber Northeim (West Germany). Inst. fuer Stratosphaerenphysik.
THE AZUR MISSION: PHYSICS OF THE MAGNETOSPHERE AND MEASUREMENT PURPOSES [DIE MISSION DES AZUR: MAGNETOSPHAERENPHYSIK UND MESSAUFGABE]
E. Keppler, E. Kirsch, L. Rossberg, E. Achtermann, G. Paschmann et al Bad Godesberg, West Ger. Bundesmin. fuer Bildung und Wiss. Oct. 1970 71 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Bildung und Wiss. Prepared jointly with Max-Planck-Inst. fuer Phys. und Astrophys., Kiel Univ., Brunswick Univ., and DFVLR, Oberpfaffenhofen
(BMBW-FB-W-70-56) Avail: NTIS; ZLDI Munich: 14,50 DM

Several aspects of the magnetosphere relevant for the mission of Azur are compiled and discussed. Those topics which might be contributed substantially by the measurements to be performed with the instruments onboard are collected and discussed in some detail. Author (ESRO)

N71-24263# Australian National Univ., Canberra. Dept. of Nuclear Physics.
EXPERIMENTAL INVESTIGATION OF O-16 + C-12 NUCLEAR BURNING AT STELLAR ENERGIES
J. R. Patterson (Adelaide Univ.), B. N. Nagoroka, G. D. Symons, and W. M. Zuk [1970] 20 p refs
(ANU-P/471) Avail: NTIS

The C-12(O-16, alpha)24 Mg and C-12(16-O,rho)27 reactions have been studied for centre of mass energies from 4.54 to 8.53 MeV to provide experimental data on their cross sections in the region of astrophysical interest. Excitation functions and angular distributions have been measured and are used to estimate the total and partial reaction cross sections for energies down to 3 MeV, at which O-16 + C-12 nuclear burning is expected to be important in stars. The cross sections for these reactions show a pronounced resonance structure similar to that found in the C-12 + C-12 system. These "quasi-molecular" resonances are grouped just below the Coulomb barrier energy and do not appear to extend below 6 MeV in C-12 + O-16 system. Author

N71-24264# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE GEOGRAPHY OF INFRARED RADIATION LAYERS IN THE UPPER ATMOSPHERE (FROM DATA ON THE KOSMOS-65)
M. N. Markov 1970 13 p refs Transl. into ENGLISH from Kosm. Issled. (USSR), v. 8, no. 6, 1970 p 904–914
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

An analysis of measurements made with the Cosmos 65 satellite shows an essentially nonuniform distribution of layers of infrared radiation over global areas for the 90 to 300 kilometer range. Layers are encountered most frequently in the equatorial region and only seldom in the polar regions. Experiments in which the infrared radiation of the upper atmosphere was measured were conducted primarily on vertically ascending rockets. Thus only the local inhomogeneities in the radiation field could be assessed from their results. Author

N71-24266 Washington Univ., Seattle.
THE HELIO-CENTRIC Z GRADIENT IN PRIMARY COSMIC RAYS
John Thomas Anderson Ely (Ph.D. thesis) 1969 140 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 70-8451

Cerenkov scintillator particle telescopes designed to measure the charge and energy spectra of heavy primary cosmic rays were flown on research satellites OV1-10 and OV1-86 in low altitude polar orbits and recorded data over most of 1967. Observed was that: (1) OV1-10 launched on 11 December 1966 made an unambiguous measurement of charge in the range Z = 9 to 16 (F to S) above 5 Bev/n; (2) both OV1-10 and OV1-86 showed a latitude dependence of the Z spectrum; and (3) solar sector synchronous modulation. A smaller percentage of VH (Z > 20) and a higher percentage of L(Z = 3-5) nuclei were found at the equator than at higher latitudes. The reduction of about 30% in the VH/S ratio with increasing energy indicates a more negative VII differential spectrum slope by about 10%. Dissert. Abstr.

N71-24274 Denver Univ., Colo.
ENERGY SPECTRA OF PRECIPITATING ELECTRONS FROM SIMULTANEOUS BALLOON OBSERVATIONS OF OPTICAL AND X-RAY AURORA
Andrew Brent Christensen (Ph.D. Thesis) 1969 185 p
Avail: Univ. Microfilms: HC $8.40/Microfilm $3.00 Order No. 70-7529

Simultaneous balloon observations of auroral positive N2 shows (wavelength 3914) emission and bremsstrahlung X-rays produced by the precipitation of energetic electrons in the auroral zone suggest that two distinct groups of electrons are responsible for the observed effects. One group is mainly responsible for the X-ray flux above 40 keV. A separate group of particles provides the major energy influx during optical aurora. Calculations of the intensity of resonance scattered 3914A radiation from sunlit aurora are discussed. The calculations indicate that for electron spectra characterized by energies greater than 10 keV, the 3914A intensity due to electron impact is enhanced less than 10% by resonance scattered sunlight. However, for characteristic energies less than 5 keV, the resonance scattered contribution becomes appreciable. Dissert. Abstr.

N71-24323 Stanford Univ., Calif.
ANISOTROPY AND INHOMOGENEITY IN THE COSMIC BACKGROUND RADIATION
Edward Kirkham Conklin (Ph.D. Thesis) 1969 138 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 70-10443

Methods for measuring the anisotropy and inhomogeneity in Earth cosmic background radiation are presented. Homogeneity measurements were made at 10,690 MHz. The primary antenna beamwidth was 13 minutes of arc and repeatedly scanned a strip of sky from 10 h to 22 h right ascension at declination plus 40.6 degrees. Anisotropy measurements were made at 8,000 MHz with an angular resolution of 15 degrees. The input to a sensitive radiometer was switched between two antennas so that the system measured the temperature difference between points 5 h apart in right ascension over a circle where sigma equals plus 32 degrees. Dissert. Abstr.

N71-24324 California Univ., San Diego.
INTERSTELLAR ABSORPTION OF X-RAYS BY PHOTOIONIZATION OF HELIUM AND MOLECULAR HYDROGEN
Robert Lamme Brown (Ph.D. Thesis) 1969 177 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 70-8645

Recognizing the cosmic X-ray sources will have their spectra strongly attentuated at energies less than the oxygen K-shell ionization edge primarily through photoionization of helium and hydrogen, the cross sections for these processes have been considered. The helium photoionization cross section in which the residual ion is left in its ground state, is calculated using various bound state wave functions having one to fourteen parameters. Calculations are performed using both the dipole position and momentum matrix elements; the continuum electron is described by the Born approximation and by a Coulomb wave. It is found that while the coefficient of the first order Born term is large causing the Born expansion to be slowly converging, nevertheless cross sections obtained using this approximation become increasingly accurate as the bound state was function is improved. Dissert. Abstr.

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N71-23176# Joint Publications Research Service, Washington, D.C.
SOVIET BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 249
31 Mar. 1971 52 p Transl. into ENGLISH from Russian reports (JPRS-52766) Avail: NTIS

CONTENTS:
1. ASTRONOMY p 1-5 (See N71-23177 12-30)
2. METEOROLOGY p 6-15 (See N71-23178 12-20)
3. OCEANOGRAPHY p 16-18 (See N71-23179 12-13)
4. TERRESTRIAL GEOPHYSICS p 19-28 (See N71-23180 12-13)
5. UPPER ATMOSPHERE AND SPACE RESEARCH p 29-44 (See N71-23181 12-30)

N71-23177# Joint Publications Research Service, Washington, D.C.
ASTRONOMY
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 249 31 Mar. 1971 p 1-5 (See N71-23176 12-30)
Avail: NTIS

Astronomical observations and instrument development are reported. Red dwarf observations with a new image converter, comet observations with a polarimeter, thermophysical properties of lunar surface matter extracted by Luna 16, spectrometric measurements of pulsar variations, and atmospheric currents and turbulence in the M zone studied from meteor trail photographs are described. Activities of the Abastumani Astrophysical Observatory, installation of a large solar telescope in Siberia, and the installation of a high power Schmidt camera designed to photograph weak celestial objects are mentioned. N.E.N.

N71-23181# Joint Publications Research Service, Washington, D.C.
UPPER ATMOSPHERE AND SPACE RESEARCH
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 249 31 Mar. 1971 p 29-44 (See N71-23176 12-30)
Avail: NTIS

Space program activities, ionospheric soundings, and related research are reported. Ionospheric inhomogenieties, disturbances, and conductivity; vertical ionospheric sounding by quasichromatic waves; auroral activity, electrojet, and radio reflections; ionospheric propagation; and atmospheric temperature measurements are discussed. Solar X-ray flare investigations, and color TV transmission in remote areas and by satellite are reviewed. The launchings of Cosmos satellites 397, 398, and 399 are reported, along with continuing investigations on spacecraft materials. Lunokhod 1 activities and the gathering of lunar soil samples by probes similar to Luna 16 are described. N.E.N.

N71-23203*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MISSION SUPPORT
In its The Deep Space Network, Vol. 2 15 Apr. 1971 p 6-41 refs (See N71-23201 12-11)
Avail: NTIS CSCL 22A

Deep Space Network tracking, data acquisition, data management, and interface capabilities for support of Pioneer F and G missions, Helios Project, Viking Mars 1975 missions, and Apollo 14 are presented. Brief descriptions are also given for each of the missions and projects. A.L.

N71-23259# Radio and Space Research Station, Slough (England).
CATALOGUE OF ROCKET AND SATELLITE DATA IN WORLD DATA CENTRE C, 1970 ISSUE NO. 1
1970 48 p
Avail: NTIS

Satellite and rocket launching data are presented with satellite sightings. The launching data are tabulated in chronological order, while sightings are tabulated in alphabetical order. F.O.S.

N71-23260# Radio and Space Research Station, Slough (England).
CATALOGUE OF ROCKET AND SATELLITE DATA IN WORLD DATA CENTRE C, 1970 ISSUE NO. 2
1970 22 p
Avail: NTIS

For abstract, see N71-23260.

N71-23716*# TRW Systems Group, Redondo Beach, Calif.
RTG/SCIENCE INSTRUMENT RADIATION INTERACTIONS FOR DEEP SPACE PROBES, PHASE 2, 3, AND 4
R. A. Kaminskas, J. S. Brunhouse, and K. T. Hartwig 31 Jan. 1971 196 p refs
(Contract NAS2-5222)
(NASA-CR-114297) Avail: NTIS CSCL 04A

The results are summarized of three phases of program aimed at providing experimenters using scientific instruments onboard

RTG-powered spacecraft with basic data to assess the interference caused by the radiation emanating from the RTG. The projects reported include: (1) a study of radiation interference specifically for Pioneer F/G instruments; (2) an effort aimed at providing an accurate and versatile simulation of the Pioneer F/G radiation environment for radiation interference testing using a mass mockup of the Pioneer F/G spacecraft and simulated SNAP-19 RTG radiation sources; and (3) a task to perform a tradeoff study to determine the relative benefits that can be gained in reducing the RTG and RHU radiation interference with scientific instruments. D.L.G.

N71-23721# State Univ. of New York, Stony Brook. College of Engineering.
A RADIATIVE TRANSFER MODEL FOR PLANETARY ATMOSPHERES
R. D. Cess [1970] 21 p refs Submitted for publication
(Grant NSF GK-16755)
Avail: Issuing Activity

The method of matched asymptotic expansions is applied to the analysis of infrared radiative energy transfer within a planetary atmosphere. The goal is to illustrate, by means of a simple mathematical model, qualitative features of atmospheric thermal structure. The matched asymptotic expansion is employed in the upper portion of the atmosphere, and the analysis illustrates that the temperature distribution in the lower portion of the atmosphere is independent of both concentration of absorbing gas and rotational line structure of the vibration-rotation bands. Author

N71-23723* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MILLIMETER WAVE RADIOMETER FOR RADIO ASTRONOMY Patent
Anthony Giandomenico and Willard van Tuyl Rusch, inventors (to NASA) Issued 17 Dec. 1968 (Filed 18 Apr. 1967) 8 p Cl. 343-100 Sponsored by NASA
(NASA-Case-XNP-09832; US-Patent-3,417,399;
US-Patent-Appl-SN-632163) Avail: US Patent Office CSCL 03A

A synchronous detection system capable of detecting exceptionally weak radio-astronomical signals is discussed. The system, including a Cassegrainian type microwave antenna, has a mechanical switching assembly where the antenna beam may be periodically switched from a distant source of radio astronomical signals to a position in space adjacent to but displaced from the source so as to permit the detection system to distinguish an actual signal from background noise. Mechanical switching within the system is achieved by a periodically tilting or nodding of the auxiliary hyperboloidal reflecting subdish which forms a part of the Cassegrainian antenna. The synchronous detection system also includes means for thermal noise calibration of the system. Official Gazette of the U.S. Patent Office

N71-23850# Universidad Nacional de Colombia, Bogota. Facultad de Ciencias.
ANNUAL OF THE NATIONAL ASTRONOMICAL OBSERVATORY FOR 1970 [ANUARIO DEL OBSERVATORIO ASTRONOMICO NACIONAL 1970]
1970 112 p refs In SPANISH
Avail: NTIS

The 1970 almanac of astronomical ephemerides is presented. Included are the ephemerides for the sun, moon, planets, and stars. Time conversion tables are also included. Transl. by F.O.S.

N71-23855*# National Aeronautics and Space Administration, Washington, D.C.
NEW X-RAY STAR
31 Mar. 1971 6 p
(NASA-News-Release-71-50) Avail: NASA Scientific and Technical Information Facility, P.O. Box 33, College Park, Md. 20740 CSCL 03A

A pulsating X-ray star quite unlike the one other known X-ray pulsar was detected in the Milky Way galaxy by Explorer 42, the Small Astronomy Satellite, launched last Dec. 12. The newly detected X-ray pulsar, 13 new X-ray objects found both within the Milky Way and several remote galaxies, and confirmation that a distant quasar is a source of powerful X-rays, are included in the initial scientific results from Explorer 42. The X-ray pulsar, identified as Cygnus X-1 in the Constellation Cygnus, was observed by the satellite to generate precisely timed X-ray pulses at the rate of about 15 per second. Author

N71-23963*# Scientific Translation Service, Santa Barbara, Calif.
SCHEDULE OF FRENCH SPACE ACTIVITIES FOR 1970
Pasadena, Calif. JPL Mar. 1971 7 p Transl. into ENGLISH of Natl. Center for Space Studies, Paris, report Prepared for JPL (Contract NAS7-100)
(NASA-CR-118045) Avail: NTIS CSCL 22A

Rocket, balloon, and satellite launchings, international cooperative activities, and conferences attended are listed. N.E.N.

N71-23991# Konkoly Observatory, Budapest (Hungary).
INFORMATION BULLETIN ON VARIABLE STARS 1969 – 1970, NUMBERS 401-500
L. Detre and B. Szeidl, eds. 1970 19 p refs
Avail: NTIS

A listing of publications for 1969 and 1970 is presented, along with an author index and an index of variables. N.E.N.

N71-23992# Tel-Aviv Univ. (Israel). Dept. of Environmental Sciences.
PAPERS OF STAFF MEMBERS OF THE INSTITUTE OF PLANETARY AND SPACE SCIENCE AND THE DEPARTMENT OF ENVIRONMENTAL SCIENCES, TEL-AVIV UNIVERSITY SINCE 1960
Dec. 1969 36 p refs
Avail: NTIS

A bibliography is presented on planetary and space science, plasma physics, wave transmission, atmospheric effects, and mathematics applied to these topics. N.E.N.

N71-23993# Radio and Space Research Station, Slough (England).
CATALOGUE OF REPORTS AND REPRINTS IN WORLD DATA CENTRE C1: ROCKETS AND SATELLITES, PUBLICATIONS RECEIVED FOR THE PERIOD 1 JULY – 31 DECEMBER 1970
31 Dec. 1970 6 p refs
Avail: NTIS

The list presented includes reports on general space research, satellite experiments and applications, interplanetary flight guidance, solar and trapped radiation, earth atmosphere, and planetary spectroscopy. N.E.N.

N71-24075*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ORBITAL ANALYSES OF THE QUICK LOOK ASTROSOVIET OPTICAL TRACKING DATA FROM THE ISAGEX PRELIMINARY EXPERIMENT, 15 SEPTEMBER – 31 OCTOBER, 1970
J. G. Marsh, J. P. Murphy, and R. W. Agreen Nov. 1970 42 p
(NASA-TM-X-65488; X-552-70-450) Avail: NTIS CSCL 22A

During the period of September 15 to October 30, 1970, a Preliminary ISAGEX Experiment was conducted as a test of the networks to provide timely accurate quick look data. Some preliminary conclusions regarding this pre-experiment are presented. Since Baker-Nunn data has been used for over a decade at Goddard for orbit determination, this study was primarily concerned with processing the NAFA-25 observations made available during this period which have heretofore never been available. Results are

presented when these data are used in orbit computations and predictions along with other quick look data. Preliminary results indicate that the accuracy of these data are of the order of a few minutes of arc. Author

N71-24084*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NEUTRAL HELIUM, ATOMIC OXYGEN, AND MOLECULAR NITROGEN DENSITIES FROM THE EXPLORER 32 MASS SPECTROMETERS
C. A. Reber, A. E. Hedin, and J. E. Cooley Washington Apr. 1971 31 p refs
(NASA-TN-D-7042; G-1013) Avail: NTIS CSCL 22A

The magnetic mass spectrometers on the Explorer 32 aeronomy satellite provided data on the neutral atmospheric constituents in the altitude range 286 km to 1000 km from May 26 to June 1, 1966. Comparison with the Jacchia 1965 model shows good agreement for molecular nitrogen densities and the measured atomic oxygen about a factor of 5 lower than the model. The ion sources of the mass spectrometers were enclosed and coated to enhance recombination of the atomic oxygen. It is likely that a significant loss of oxygen occurred on the walls during the brief measurement period and that the absolute oxygen data are of little geophysical significance. The data for molecular nitrogen and atomic oxygen are best fitted with an increase in exospheric temperature of about 160 K, or a much smaller latitudinal temperature effect than the model predicts, along with a decrease in atomic oxygen density with increasing latitude. Author

N71-24111# New Hampshire Univ., Durham. Antenna Systems Lab.
COMPUTER PROCESSING OF DATA FROM THE UNH/AFCRL METEOR TRAILS RADAR
Filson H. Glanz and Ronald R. Clark 20 Aug. 1970 40 p refs
(Contract F19628-67-C-0230)
(AD-718105; AFCRL-70-0717; SR-4) Avail: NTIS CSCL 4/1

The report describes the UNH Meteor Trails Radar Main Off-Line Computer Program. The report consists of a summary of the program and a complete listing and flow graph of the program. The main contribution is the method of determining azimuth and elevation angles from the UNH/AFCRL Meteor Trails Interferometric azimuth-elevation system. Author (GRA)

N71-24113*# National Aeronautics and Space Administration, Washington, D.C.
TENTH ANNIVERSARY OF US MANNED SPACE FLIGHT: NEWS RELEASE
Louise Dick 2 May 1971 9 p
(NASA-TM-X-67150) Avail: NASA Scientific and Technical Information Facility, P. O. Box 33, College Park, Md. 20740 CSCL 22 A

A news release summary of the achievements of the U.S. manned space flights for the past decade is presented. The Mercury, Gemini, and Apollo flights are reviewed. Some of the findings of the manned flights are: ages of rocks and soils returned range from 3.3 to 4.6 billion years; numerous moonquakes occur when the moon is closest to the earth during its monthly cycle; and the laser reflector experiment enables scientists to determine the earth-moon distance to a precision of 15 to 30 centimeters, which will increase the knowledge of wobbles of the earth's axis. F.O.S.

N71-24146*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
LUNAR ELECTRICAL CONDUCTIVITY FROM APOLLO 12 MAGNETOMETER MEASUREMENTS: COMPOSITIONAL AND THERMAL INFERENCES
C. P. Sonett, G. Schubert (Calif. Univ., L.A.), B. F. Smith (Calif. Univ., L.A.), K. Schwartz (Am. Nucleonics Corp., Woodland Hills, Calif.) and D. S. Colburn Apr. 1971 44 p refs Submitted for publication
(NASA-TM-X-62019) Avail: NTIS CSCL 03C

The lunar electrical conductivity profile has been obtained from an iterative fit of theoretical electromagnetic transfer functions to empirical ones based on joint power spectral density analyses of data from the Apollo 12 Lunar Surface Magnetometer and the Ames Explorer 35 magnetometer. Seven selected two hour swaths and seven selected one hour swaths of data were used. The spectrum analyzed ranged in frequency from 0.00083 to 0.04 Hz. The amplification of the interplanetary magnetic field at the lunar surface showed a distinct increase from approximately 1 at 0.001 Hz to approximately 3 at 0.005 Hz. At higher frequencies the slope of the amplification vs. frequency curve decreases until the amplification levels off at about 4 at 0.025 Hz. An amplification curve with such a distinct bend is best fit by a lunar conductivity model with a sharp maximum around 1500 km radius, so that high frequency variations in the magnetic field are compressed into the outer shell while low frequency variations can penetrate to the interior. Author

N71-24206# State Univ. of New York, Stony Brook. College of Engineering.
A NOTE ON RADIATIVE TRANSFER IN LUNAR AND MERCURIAN SURFACES
R. D. Cess and J. Srinivasan [1970] 7 p refs Submitted for publication
(Grant NSF GK-16755)
Avail: Issuing Activity

A linearized counterpart to the analysis of Ulrichs and Campbell (1969) is presented for thermal emission from Lunar and Mercurian surfaces. It is illustrated that the linearized analysis may easily be extended to incorporate additional features of the transient cooling process. Author

N71-24207# California Univ., Los Angeles. Dept. of Astronomy.
CHEMICAL COMPOSITION OF GASEOUS NEBULAE, HIGH TEMPERATURE STARS, AND STARS OF UNUSUAL METAL TO HYDROGEN RATIOS Final Technical Report
Lawrence H. Aller 31 Dec. 1970 90 p refs
(Grant AF-AFOSR-0083-67)
(AD-718441; AFOSR-70-2895TR) Avail: NTIS CSCL 3/2

Chemical compositions of gaseous nebulae, and the atmospheres of both normal stars and objects with unusual metal/H ratio have been investigated by procedures of modern spectrophotometry and stellar atmosphere theory. Particular attention has been paid to the physics of gaseous nebulae as representing an example of an extended, highly attenuated, steady state, ionized plasma. The methods developed and results obtained have an impact in other areas of astrophysical interest--extended stellar envelopes, the solar corona, the filamentary structures of objects such as the solar chromosphere. Author (GRA)

N71-24228*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
COMPARISON OF THE SAO STAR CATALOG WITH CAPE CATALOGUES FROM -84 DEG TO -90 DEG
K. Haramundanis 15 Oct. 1970 20 p refs
(Grant NGR-09-015-002)
(NASA-CR-118033; SAO-Special-Rept-325) Avail: NTIS CSCL 03A

A comparison of the positions and proper motions of the Smithsonian Astrophysical Observatory (SAO) Star Catalog with new observations in the region of the south celestial pole indicates that the SAO data appear to contain systematic deviations that are source dependent. Data are tabulated for the epoch 1950.0. Author

N71-24237 Indiana Univ., Bloomington.
HYDRODYNAMIC ATMOSPHERES OF A CEPHEID VARIABLE
Charles F. Keller, Jr. (Ph.D. Thesis) 1969 180 p
Avail: Univ. Microfilms: HC $8.20/Microfilm $3.00 Order No. 70-10265

Shallow-envelope, hydrodynamic calculations were carried out for a theoretical, cepheid, variable star model corresponding to the deep-envelope model. Comparisons of these models with observations show that they have light curves which are inconsistent with their period of pulsation. The light curves most nearly approximated are those of cepheids with periods in excess of 20 days. One result is the determination that Wesselink's method is a valid way of determining the radii of cepheids. By including line-blanketing opacity in the static atmospheres, good agreement is achieved with observations on a plot of color index, B-V, and effective temperature. Dissert. Abstr.

N71-24238 Lowell Observatory, Flagstaff, Ariz.
LOWELL PROPER MOTION SURVEY, NORTHERN HEMISPHERE. THE G NUMBERED STARS: 8991 STARS FAINTER THAN MAGNITUDE 8 WITH MOTIONS GREATER THAN 0.26 SECONDS PER YEAR
H. L. Giclas, R. Burnham, Jr., and N. G. Thomas 23 Feb. 1971 175 p refs Supported by NSF
Avail: Issuing Activity

The results of the Lowell proper motion survey for the Northern Hemisphere are catalogued, including observed positions, proper motions, magnitudes, and colors for 8991 stars. The proper motion data were prepared for stars identified and measured directly on the calibrated screen of a projection comparator using plates with a 13 in. photographic telescope. Author

N71-24243*# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
Ku-BAND INTERFEROMETRY
George D. Papadopoulous (Ph.D. Thesis) 31 Dec. 1970 121 p refs
(Grant NGL-22-009-016)
(NASA-CR-117903; TR-481) Avail: NTIS CSCL 03A

The construction of a Ku-band radio interferometer and some preliminary observations are reported. The interferometer was built for the purpose of mapping some discrete ratio sources: the Crab Nebula, Cas A, and Cyg A. The system contains two 8 ft parabolic antennas and receives radiation at 17.128 GHz (1.75 cm). The maximum baseline length of 100 m corresponds to a resolution of 35 seconds of arc. A PDP-8 computer is incorporated in the system and used for pointing, tracking, delay, compensation, and real-time data analysis. The phase stability of the system was found to be better than 10 deg over a period of 2 hours. Consistent fringe components were obtained from the Crab Nebula with the baseline set at 8 m. Author

N71-24244*# National Aeronautics and Space Administration, Washington, D.C.
INTENSITY OF GAS PRODUCTION IN COMETS [INTENSIVNOST VYDELENIYA GAZOV V KOMETAKH]
V. G. Fliyvas Mar. 1971 11 p refs Transl. into ENGLISH from Komety i Meteory (Dushanbe), no. 13, 1966 p 3–8
(NASA-TT-F-13492) Avail: NTIS CSCL 03C

It was found on the basis of previously obtained photometric parameters of comets that the efficiency of gas production per unit area is approximately the same for all investigated comets. Various comet models are discussed and the process of sublimation of comet ice is shown to have a good fit to observed data. The total efficiency of gas production appears to be four to five orders greater than the C2 and CN. Author

N71-24245*# National Aeronautics and Space Administration, Washington, D.C.
SCIENTIFIC RESULTS FROM FLIGHTS OF THE UNMANNED IONOSPHERIC LABORATORIES 'YANTAR', PART 3 [NAUCHNYYE REZULTATY POLETOV AVTOMATICHESKIKH IONOSFERNYKH LABORATORIY 'YANTAR', CHAST 3]
G. L. Grodzovskiy et al Apr. 1971 23 p refs Transl. into ENGLISH of a Russian report presented at the 21st Intern. Astronaut. Congr., Constance, West Ger., 1970 p 1–26
(NASA-TT-F-13550) Avail: NTIS CSCL 21H

Using geophysical rockets, unmanned ionospheric laboratories "Yantar'" with gas ion plasma engines were launched to altitudes of 100-400 km to investigate the possibilities of guided flight in the upper layers of the atmosphere. Operation of the gas ion plasma engines, using argon, nitrogen, and air, was investigated under flight conditions in the ionosphere. The parameters characterizing the interaction of the ion stream with the ionospheric plasma and the parameters of the neutral atmosphere were measured. The scientific results of the flight experiments that were carried out are presented. Author

N71-24288*# National Aeronautics and Space Administration, Washington, D.C.
EVALUATION OF THE INTENSITY OF DEIONIZATION PROCESS IN METEOR TRACKS [K OTSENKE INTENSIVNOSTI PROTSESSOV DEIONIZATSII V METEORNOM SLEDE]
Ye. I. Fialko Mar. 1971 11 p refs Transl. into ENGLISH from Komety i Meteory (Dushanbe), no. 13, 1966 p 22–28
(NASA-TT-F-13494) Avail: NTIS CSCL 03C

The method of evaluation of the coefficient of electron attachment to oxygen molecules beta sub n previously given was applied to the result of radar observations of meteors in 1957-1959 at lambda = 10 m. The value obtained for beta sub n approximately (0.35-0.37) cc/sec differs only slightly from that given by Davies, Greenhow and Hall. Author

N71-24289*# National Aeronautics and Space Administration, Washington, D.C.
SOME PROBLEMS OF THE PHYSICAL THEORY OF METEORS [NEKOTORYE VOPROSY FIZICHESKOY TEORII METEOROV]
V. N. Lebedinets et al Mar. 1971 20 p refs Transl. into ENGLISH from Komety i Meteory (Dushanbe), no. 13, 1966 p 9–21
(NASA-TT-F-13493) Avail: NTIS CSCL 03C

The effective cross-sections of meteor atom and molecule diffusion are determined and applied to problems in the physical theory of meteors. One possible mechanism of fragmentation of small meteor bodies leading to the appearance of radiometeors is considered. Author

N71-24290*# National Aeronautics and Space Administration, Washington, D.C.
RATES OF METEOR ECHOES AT lambda = 10 m DURING THE IGY-IGC [CHISLENNOST METEOROV NA lambda = 10 m V PERIOD MGG-MGS]
Ye. I. Fialko Mar. 1971 8 p refs Transl. into ENGLISH from Komety i Meteory (Dushanbe), no. 13, 1966 p 41–46
(NASA-TT-F-13496) Avail: NTIS CSCL 03C

Results of observations of meteor radio echo rates on lambda = 10 m in Tomsk during the IGY-IGC period (1957-1959) are presented. The diurnal and seasonal hourly rates are compared with those obtained in Khar'kov. Author

N71-24309*# Lunar Science Inst., Houston, Tex.
COMMENTS ON RINGWOOD'S PAPER 'PETROGENESIS OF APOLLO 11 BASALTS AND IMPLICATIONS FOR LUNAR ORIGIN'

S. Fred Singer (Interior Dept.) Jan. 1970 12 p refs Supported in part by Univ. Space Res. Assoc. *Its* Contrib. No. 28
(Contract NSR-09-051-001)
(NASA-CR-118034) Avail: NTIS CSCL 03C

Critical comments are presented on Ringwood's (1966) discussion of various theories of lunar origin emphasizing the precipitation mechanism. The composition of lunar basalts is discussed based on Apollo 11 rock samples. It is shown that many theories on lunar evolution can give a satisfactory explanation. The comparison of earth basalts and mantle rocks with lunar basalts is cited. Various hypotheses are mentioned to explain the low iron content and the depletion of volatiles in the moon including the fission theory and capture theory. J.M.

N71-24310*# Techtran Corp., Glen Burnie, Md.
RESULTS OF OBSERVATIONS OF THE POLARIZATION EFFECT FOR SPORADIC METEORS [REZULTATY NABLYUDENIY POLARIZATSIONNOGO EFFEKTA DLYA SPORADICHESKIKH METEOROV]
E. K. Nemirova Washington NASA Mar. 1971 16 p refs Transl. into ENGLISH from Komety i Meteory (Dushanbe), no. 13, 1966 p 29–40
(Contract NASw-2037)
(NASA-TT-F-13495) Avail: NTIS CSCL 03B

Methods and observation results of the polarization effect accompanying the diffuse reflection of radio waves by meteor trails with sporadic background at a wavelength lambda = 10 m are presented. Author

N71-24313 California Univ., San Diego.
A LABORATORY MODEL FOR RADIO STAR SCINTILLATION AND OTHER DIFFRACTION PHENOMENA
Millett Granger Morgan, II (Ph.D. Thesis) 1969 102 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 70-8844

The diffraction of a radio star signal by a thin, weak, random phase changing screen such as the earth's ionosphere or the solar wind, was modeled in the laboratory using 40 kHz airborne ultrasonic sound and a diffracting screen of warm turbulent air. A phase coherent system, and temperature probes mounted in the diffracting region, provided information not available in typical radio star observations. Direct measurements of the turbulent screen were used to explore several techniques for the determination of the mean drift velocity of a drifting random structure which is undergoing internal rearrangement. Acoustic measurements confirmed the theory for the simple thin, weak phase screen and have pointed up several unexpected complications in the modeling process. Dissert. Abstr.

N71-24316 Rensselaer Polytechnic Inst., Troy, N.Y.
LARGE SCALE MAGNETIC FIELD INFLUENCES ON INTERSTELLAR GAS MOTIONS AND ON GALACTIC SPIRAL STRUCTURE
Ronald Paul Lepping (Ph.D. Thesis) 1969 203 p
Avail: Univ. Microfilms: HC $9.25/Microfilm $3.00 Order No. 70-11324

A simplified model of part of our Galaxy's spiral structure region containing both gravitational and magnetic forces, is developed. It is assumed that the systematic gas difference velocity caused by the presence of a large scale weak magnetic field is an order of magnitude, or more, smaller than the gas velocity which would result from the perturbative spiral gravitational field alone. The latter velocity is assumed to be the same for the young stars and the gas. These assumptions lend themselves conveniently to a linear analytical treatment. The theory is based on the hypothesis of quasi-stationary spiral structure and stems from a density wave concept. Dissert. Abstr.

N71-24317 Texas Univ., Austin.
INHOMOGENEITIES IN PLANETARY NEBULAE
Ronald Crecelius Kirkpatrick (Ph.D. Thesis) 1969 177 p
Avail: Univ. Microfilms: HC $8.20/Microfilm $3.00 Order No. 70-10819

Planetary nebulae have been described as faint, hazy, planet-like disks when observed through a telescope of small aperture. Observation with higher resolution reveals a variety of nebular shapes and small scale structure. Spectroscopic studies of these objects revealed that they consist of a low density gas distributed about a high temperature star, the ultraviolet radiation of which ionizes and thereby illuminates the gas. The physical processes shown by Menzel to be responsible for nebular emission have been incorporated into axially symmetric theoretical emission models of planetary nebulae for comparison with observations. Also, several possible nebular circumstances which may coexist in planetary nebulae have been analyzed. Dissert. Abstr.

N71-24337*# Martin Marietta Corp., Denver, Colo.
JUPITER ATMOSPHERIC ENTRY MISSION STUDY. VOLUME 3: SUPPORTING TECHNICAL STUDIES Final Report
Apr. 1971 689 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952811)
(NASA-CR-118021; MCR-71-1-Vol-3) Avail: NTIS HC $9.00/MF $0.95 CSCL 22A

The results are presented for parametric and technology studies which were done in support of the overall mission and system studies and the conclusions and recommendations for Jupiter atmospheric entry missions. The efforts include trade studies in the areas of science, navigation and trajectory, telecommunications, and mechanical subsystems design. In addition, the mission effectiveness model is described, the trial mission supporting studies are discussed, and miscellaneous appendixes are included. The science studies define the science objectives, questions to be answered, the relevant measurements, and the science instrument implementation. Results of these studies provide the basis for the science payload and support requirements, probe system design, and descent as well as encounter trajectory shaping. The navigation and trajectory studies provide the parametric data required in support of the mission design including the basic trades on available launch capability and date, trajectory type, encounter geometry, and targeting. The telecommunications and mechanical system studies provide design data for the hardware implementation for the probe, spacecraft and launch vehicle. Author

N71-24338*# Martin Marietta Corp., Denver, Colo.
JUPITER ATMOSPHERIC ENTRY MISSION STUDY. VOLUME 2: MISSION AND SYSTEM EVOLUTION Final Report
Apr. 1971 353 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952811)
(NASA-CR-118022; MCR-71-1-Vol-2) Avail: NTIS HC $6.00/MF $0.95 CSCL 22A

The rationale and evolution of mission and system concepts are described for Jupiter atmospheric entry missions. In addition to the descriptions of the environmental models, the science criteria selection rationale, the mission and system concept evolution, the baseline parametric mission study, a detailed design example mission from the parametric study, and a variety of illustrative sample missions are included. The environmental models and the science criteria established the fundamental design factors for the implementation of the engineering designs. The mission and system concepts evolved within the bounds established by feasible engineering solutions. From these concepts, the baseline parametric study was developed, and a Design Example mission was selected to be defined in detail in order to illustrate the subsystem and system integration and interfaces. Other sample missions are defined in less detail, and illustrate some of the unique problems and solutions associated with particular mission options. Author

N71-24339*# Martin Marietta Corp., Denver, Colo.
JUPITER ATMOSPHERIC ENTRY MISSION STUDY. VOLUME 1: MANAGEMENT SUMMARY Final Report
Apr. 1971 115 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952811)
(NASA-CR-118023; MCR-71-1-Vol-1) Avail: NTIS CSCL 22A

The material presented summarizes management efforts and products of six-month study of a Jupiter atmospheric entry mission. Included are the study constraints, a summary of the science and mission objectives, a discussion of the mission analysis and selection rationale, a description of the required engineering implementation, and the conclusions and recommendations. The basic study objectives were to assess the technical feasibility of a Jovian atmospheric entry mission in a 1978 Launch opportunity, and to define the gross mission and technology requirements. Probe survival to pressures up to 1000 atmospheres was evaluated and a realistic upper pressure limit selected that would permit the direct measurement of physical parameters and phenomena well below the tops of the visible clouds. Author

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N71-23158*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
LRV OPERATIONAL BEHAVIOR STUDY
Fritz Kramer 12 Feb. 1971 62 p
(NASA-TM-X-64584) Avail: NTIS CSCL 22B

Operational behavior of the LRV under lunar gravitation was studied using a four-wheel mathematical model with three degrees of freedom. Motion was determined on smooth, horizontal, and sloping planes under the influence of the individual wheel forces and the grade component of the gravitational force. Because of the low value of lunar gravitation, all motion is characterized by its creation through acceleration forces, which are small in comparison to mass or inertia forces. Author

N71-23164*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
METHOD FOR ESTIMATING MINIMUM REQUIRED EJECTION VELOCITY FOR PARACHUTE DEPLOYMENT
Earle K. Huckins, III and Lamont R. Poole Washington Apr. 1971 20 p refs
(NASA-TN-D-6300; L-7704) Avail: NTIS CSCL 22A

An approximate method for estimating the minimum required ejection velocity for parachute deployment was developed The approach used was to obtain a first integral to the equation for the linear motion of an inelastic parachute deployed in the lines-first mode. A criterion was developed which limits the theory to forced ejection deployments. The theory was extended for application to static vertical ground tests and for cases in which nonzero bag-strip velocity is desired. Results obtained using the new approximation closely agreed with results obtained by numerical integration for a series of hypothetical sample cases. Author

N71-23198*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SHADOWGRAPHS AND SURFACE FLOW VISUALIZATION PHOTOGRAPHS OF THE MSC ORBITER AT MACH NO. 7.4
H. Lee Seegmiller Jan. 1970 95 p
(NASA-TM-X-62032) Avail: NTIS CSCL 22B

Surface flow visualization photographs and shadowgraphs are presented for the Manned Spacecraft Center straight-wing orbiter concept. The tests were performed at a Mach number of 7.4 and length Reynolds number of 3,100,000 for the angle of attack range from 18 deg to 80 deg. The flow at the model surface was made visible with an oil-flow technique and the results are demonstrated in the photographs. Details of shock interactions, separated flows, wake impingements, streamline divergence, and other features of the flow are shown. Author

N71-23509*# North American Rockwell Corp., Seal Beach, Calif. Space Div.
SPACE STATION PROGRAM
1970 155 p Presented at the NASA Briefing on Space Sta. Plans and Programs, Paris, 3–5 Jun. 1970; sponsored by ESRO
(NASA-CR-117908; PDS-70-234) Avail: NTIS CSCL 22B

Some of the main features of the space station program as it is currently evolving from the Phase-B program definition study are summarized. An overall discussion of space station objectives, the systems which make up the overall program, and the benefits that are accruing from the space station program are given as well as a brief outline of the core module configurations, subsystems, and operations and second by a brief discussion of experiment modules including those which are attached to the space station, detached from the space station but operating in conjunction with the space station, and those experiments that will be undertaken within the core module. A brief summary is also given of the earth-to-orbit shuttle system, which is a vital element in providing low cost and convenient transport of personnel and materials to an orbital station. The presentation concludes with a few remarks on the program development aspects of the space station program. Author (ESRO)

N71-23510*# McDonnell-Douglas Co., Huntington Beach, Calif.
DEVELOPMENT AND USE OF A 12-MAN SPACE STATION
C. J. Dorrenbacher Jun. 1970 113 p Presented at the NASA Briefing on Space Sta. Plans and Programs, Paris, 3–5 Jun. 1970; sponsored by ESRO Sponsored by NASA
(NASA-CR-117907; MDC-G0583) Avail: NTIS CSCL 22B

The space station objective and Skylab contributions are first outlined. The 12-man space station concept is developed and the experiment capability shown. Finally the space station operations are given. It is concluded that the known technology is adequate for space stations which can grow with the experiment program and that the integral and modular experiment accommodations ensure the program flexibility and also that the concept is adaptable to future applications. ESRO

N71-23534# European Space Research and Technology Center, Noordwijk (Netherlands).
BOREAS BEHAVIOUR IN ORBIT FROM LAUNCH TO RE-ENTRY
Paris ESRO Jul. 1970 85 p refs
(ESRO-TR-9-ESTEC) Avail: NTIS

A brief outline of the history of the project is given and the behavior of the spacecraft and its systems during the life of Boreas from launch to reentry described. Scientific results are excluded as these will be reported by the experimenters. A short description of the behavior of the experiment packages has been included, however. Author (ESRO)

N71-23569# European Space Research and Technology Center, Noordwijk (Netherlands).
THE ESRO 1/AURORAE SATELLITE: INTRODUCTION
R. Jaeschke *In* ESRO Substorm Events Sep. 1969 p 115–118
(See N71-23551 12-13)
Avail: NTIS

The ESRO 1/Aurorae satellite mission and experimental design for study of the Northern polar ionosphere and auroras are described. ESRO

N71-23572# Technical Univ. of Denmark, Lyngby. Ionosphere Lab.
GEOSTATIONARY SATELLITE PROJECT
P. Stauning *In* ESRO Substorm Events Sep. 1969 p 125–130 refs (See N71-23551 12-13)
Avail: NTIS

The ESRO geostationary satellite project is described and its missions are reviewed. The areas of investigation include: (1) the basic properties of the coupling between the outer magnetosphere and the polar ionosphere; (2) the acceleration processes that supply the fluxes of energetic auroral particles and the high energy trapped radiation belt particles; (3) the generation mechanisms for magnetic disturbances and low-frequency emissions. ESRO

N71-23912* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DOCKING STRUCTURE FOR SPACECRAFT Patent
Josef Franz Blumrich, inventor (to NASA) Issued 13 May 1969 (Filed 13 Jul. 1967) 5 p Cl. 244-1; Int. Cl. B64g1/00
(NASA-Case-XMF-05941; US-Patent-3,443,773; US-Patent-Appl-SN-653277) Avail: US Patent Office CSCL 22B

A docking structure for a pair of spacecraft with the docking end of the first spacecraft having a circular opening that receives a projecting incoming element on the docking end of the second spacecraft is described. At the free end of the incoming element is the apex of a pyramid structure that diverges toward the second spacecraft and merges into a prismatic portion that is relatively shorter than the pyramid structure and is connected to the second spacecraft. The side of the circular opening in the first spacecraft initially contacts one or more corners of the pyramid portion of the incoming projecting element and subsequently guides the incoming element into the docked position wherein the side of the circular opening engages the corners of the prismatic portion of the incoming element. Energy absorbing crushable material pads are provided between the mating surfaces of the first and second spacecraft and automatic latching means are provided for locking the projecting elements within the circular openings. Official Gazette of the U.S. Patent Office

N71-23926# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AN EXPERIMENTAL SPACE STATION IN ORBIT, 14–18 JANUARY 1969
N. Kamanin et al 30 Oct. 1970 115 p Transl. into ENGLISH of the book "Eksperimentalnaya Komicheskaya Stantsiya na Orbite, 14–18 Yanvarya 1969" USSR, Izd-vo TsK VLKSM Moloday a Gvardiya, 1969 p 1–88
(AD-718284; FTD-MT-24-188-70) Avail: NTIS CSCL 22/2

The book is a popularized account of the 1969 spaceship flights Soyuz-4 and Soyuz-5 which performed docking maneuvers in space. The text is a compilation of verbatim TASS reports on the flight, interspersed with laudatory biographical sketches of the participating astronauts, and containing various expressions of greetings from foreign and domestic figures. The text concludes with a chronology of all significant Soviet space events. Pictures of the astronauts are included. Author (GRA)

N71-24035* Bell Aerosystems Co., Buffalo, N.Y.
FLEXIBLY CONNECTED SUPPORT AND SKIN Patent
William O. Leffke, inventor (to NASA) Issued 17 Dec. 1968 (Filed 8 Oct. 1965) 4 p Cl. 52-272 Sponsored by NASA
(NASA-Case-XLA-01027; US-Patent-3,416,274; US-Patent-Appl-SN-494283) Avail: US Patent Office CSCL 22B

An arrangement for fastening a skin to a frame allowing resilient and sliding movement of the skin relative to the frame along one or more axes so as to allow thermally induced expansionary and contractionary movements along these axes is described. Official Gazette of the U.S. Patent Office

N71-24040# Lincoln Lab., Mass. Inst. of Tech., Lexington.
VELOCITY REQUIREMENTS FOR RAPID INTERCEPT WITH MIDCOURSE CORRECTIONS
Michael E. Ash 23 Oct. 1970 55 p refs
(Contract F19628-70-C-0230)
(AD-718421; TN-1970-32; ESD-TR-70-320) Avail: NTIS CSCL 22/3

Formulas from Lamberts problem in celestial mechanics are presented for use in a computer program to calculate velocity requirements for rapid intercept of an earth satellite by a rocket fired from the earth or from an orbit about the earth. The rocket is assumed to receive an impulsive velocity at launch and the effect of impulsive midcourse corrections are considered. The effects of the earth rotation are included is the rocket is fired from the earth, but those due to the earths atmosphere are ignored. The rocket and target satellite are assumed to be moving in conic section in the earth's gravitational field. Author (GRA)

N71-24070*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PHASE A REPORT FOR SMALL UV ASTRONOMY SATELLITE SAS-D: TECHNICAL PLAN
Mar. 1971 275 p refs
(NASA-TM-X-67165) Avail: NTIS CSCL 22B

The instrument requirements and design criteria for the SAS-D mission were studied to provide high resolution spectroscopy in the ultraviolet region from 1150 to 3200 A. The instrument which consists of a telescope, a spectrograph, and the optical portion of the telescope pointing system is discussed. The configuration and systems of the spacecraft are described. Analyses of the mission, manuevers, trajectory and orbit, are included. F.O.S.

N71-24071*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A SUMMARY OF THE SAS-D CONCEPT FOR ASTRONOMICAL ULTRAVIOLET SPECTROSCOPY
Mar. 1971 85 p refs
(NASA-TM-X-67166) Avail: NTIS CSCL 22B

The feasibility and scientific benefits of a modest size satellite-based ultraviolet telescope were studied for the SAS-D mission. To limit the total program cost, only systems that could be accommodated within the size and weight capabilities of the Delta launch vehicle were investigated. Cost considerations also strongly influenced the selection of a synchronous orbit for the satellite. It significantly reduced the size and complexity of the ground system and also simplified the spacecraft system design. It also provided a near-real-time observing capability. The synchronous oribt did restrict the weight and therefore the size of the telescope that could be considered. However, this restriction was largely counter-balanced by the satellite instrumentation system chosen. The result is that the SAS-D system is capable of making fundamental contributions to a number of important scientific areas. Another important conclusion is that the system may be used directly, in real time, by guest observers for a major fraction of the total observing time. Both national and international use of the system is expected. Author

N71-24083*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AERODYNAMIC CHARACTERISTICS OF A LARGE-ANGLE BLUNT CONE WITH AND WITHOUT FENCE-TYPE AFTERBODIES
Kenneth W. McAlister, David A. Stewart, and Victor L. Peterson Washington Apr. 1971 48 p refs Prepared in cooperation with Army Air Mobility R and D Lab.
(NASA-TN-D-6269; A-3845) Avail: NTIS CSCL 22B

Hypersonic experiments on sting mounted and free flying models were conducted to show that the base-forward stable trim point of a large angle blunt cone can be eliminated by adding a fence-type afterbody. Several configurations were investigated in

detail and it is shown that the fence must be symmetric, have a sharp trailing edge, and provide sufficient flow relief near the base of the cone. Transonic dynamic stability characteristics were also obtained from tests of free flying models. Finally, all test results were synthesized into a continuous description of the aerodynamic characteristics for use in trajectory calculations. It was found that for a 1 rad/s rolling entry into earth's atmosphere the vehicle would be properly oriented in nose-forward flight well before peak heating even when entering with a nearly base-forward attitude. Author

N71-24178*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ATTITUDE-CONTROL PERFORMANCE OF THE IMPROVED TELEVISION INFRARED OBSERVATION SATELLITE (ITOS 1). TOS PROJECT

William M. Peacock Mar. 1971 104 p refs

(NASA-TM-X-65490; X-481-71-108) Avail: NTIS CSCL 22A

An operational description of the ITOS-1 is presented together with control performance data of the satellite in orbit, and in testing before launch. The dynamic and attitude control subsystem incorporates many similar principles and much of the same hardware as the TOS satellite, although the satellite configuration is completely different. A single rotating flywheel provides the gyroscopic stability and the required momentum interchange to keep one side of the satellite facing the earth. Magnetic torquing against the earth's magnetic field eliminates the requirement for expandable propellants which would limit satellite life in orbit. Author

N71-24179*# Ogden Technology Labs., Inc., Beaumont, Calif.

RELIABILITY TESTS CONDUCTED ON FIVE (5) CRYO-FORMED SPHERES

Aug. 1969 36 p refs

(Contract NAS8-30029)

(NASA-CR-61343; B-20415) Avail: NTIS CSCL 22B

A test program was carried out to verify the reliability of the manufacturing technology used in the production of the cyro-formed spheres, and to determine their suitability for use as replacements for the titanium Helium storage bottles currently installed in the liquid Hydrogen tanks in the S IV-B Stage of the Saturn IB vehicle. Each test is summarized and the results given at the end of the test write-up. Author

N71-24194# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.

THE EVOLUTION OF GEOS-C AND THE RADAR ALTIMETER FOR GEODETIC MEASUREMENTS

S. J. Kowal May 1970 31 p refs

(Contract N00017-62-C-0604)

(AD-718348; APL-TG-1115) Avail: NTIS CSCL 22/2

The geodetic series of satellites is traced from ANNA through GEOS-I and -II in terms of the geodetic experiments completed and proposed. The ANNA instruments included the use of four coherent frequencies for doppler tracking, a range transponder (SECOR), and flashing lights for optical beacons. GEOS-I had the ANNA instruments plus a range and range-rate transponder and laser corner reflectors. GEOS-II had all the GEOS-I instruments plus C-band radar transponders and a C-band passive tracking array. GEOS-C will have the GEOS-II experiments minus the SECOR and plus a unified S-band transponder, a satellite-to-satellite tracking experiment, and an X-band radar altimeter for measuring sea level at the subsatellite position. It is expected that the satellite-to-sea-level distance will be measured to an accuracy of 1 to 5 meters in this experiment. Author (GRA)

N71-24271*# Martin Marietta Corp., Denver, Colo.

TETHER DOCKING OF ORBITING SPACECRAFT Final Report

Frederick J. Greeb Mar. 1971 110 p refs

(Contract NAS8-25353)

(NASA-CR-103103; MCR-71-77) Avail: NTIS CSCL 22A

Tether docking of the orbiting spacecraft is discussed. A digital computer program was developed to simulate the problem of two orbital spacecraft attached by a tether. The feasibility of using a single tether to provide all of the control forces and moments required to dock two vehicles was investigated. A tether control law to accomplish this task was developed using the linearized equations of orbital motion, and was verified using the developed computer program which solves the exact equations of motion. Author

N71-24292*# Bendix Corp., Detroit, Mich. Aerospace Systems Div.

APOLLO LUNAR SURFACE EXPERIMENTS PACKAGE (ALSEP) FLIGHT SYSTEM FAMILIARIZATION MANUAL, REVISION B

15 Apr. 1969 324 p

(Contract NAS9-5289)

(NASA-CR-99604; ALSEP-MT-03-Rev-B) Avail: NTIS HC $6.00/MF $0.95 CSCL 22B

A flight system familiarization manual for the Apollo Lunar Surface Experiments Package is presented. The purpose of the manual is to familiarize personnel with the scientific objectives, equipment make-up, system deployment, and operation. Author

N71-24312*# National Aeronautics and Space Administration. Washington, D.C.

SPACECRAFT RADIATION TORQUES: SPACE VEHICLE DESIGN CRITERIA (GUIDANCE AND CONTROL)

Oct. 1969 41 p refs

(NASA-SP-8027) Avail: NTIS CSCL 22B

The torque resulting from radiation forces on the spacecraft surfaces is discussed for the design of spacecraft attitude control systems. The principal source of radiation force is direct solar illumination. Earth-reflected sunlight and infrared emission from the earth and its atmosphere are additional sources for spacecraft in earth orbit. Asymmetrical emission of electromagnetic energy (typically heat or radio signals) from onboard the spacecraft is also considered as a radiation source. Major factors in the determination radiation torques are outlined including the intensity, spectrum, and direction of the incident or emitted radiation; the shape of the surface and the location of the sun face with respect to the mass center of the spacecraft; and the optical properties of the surface upon which the radiation is incident or from which it is emitted. Solar irradiation varies as the inverse square of the distance between the spacecraft and the sun, consequently, for spacecraft in earth orbit, this contribution to the radiation force is essentially independent of altitude. Because most other distrubance torques tend to diminish with increasing altitude, radiation torque is most likely to be significant factor in the design of spacecraft with large surface area that operate at orbital altitudes above about 1000 km. Author

N71-24314*# National Aeronautics and Space Administration, Washington, D.C.

MARINER MARS 1971: PRESS KIT

30 Apr. 1971 66 p refs

(NASA-News-Release-71-75) Avail: NASA Scientific and Technical Information Facility, P. O. Box 33, College Park, Md. 20740 CSCL 22B

The launch windows and scientific objectives of the Mariner Mars missions 1971 are presented. The spacecraft are to study the surface and atmosphere of Mars in detail by mapping 70% of the planet and by observing surface changes as well as changes in the atmosphere over selected areas on Mars. Mission planning considers a basic mission of 90 days in orbit around the planet with possible mission extension up to one year. G.G.

N71-24315* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
RING WING TENSION VEHICLE Patent
John S. Mixson, inventor (to NASA) Issued 15 Oct. 1968 (Filed 10 Oct. 1966) 3 p Cl. 244-1
(NASA-Case-XLA-04901; US-Patent-3,405,887; US-Patent-Appl-SN-586325) Avail: US Patent Office CSCL 22B

A ring wing entry vehicle is designed so that all the major structural components are stressed in tension upon entry into a low density atmosphere. Provided is a main shell shaped to produce tension stresses in response to gas flow drag, and a ring wing secured to the shell and shaped to produce lift forces directed so as to counteract and absorb the compressive reaction forces. Official Gazette of the U.S. Patent Office

N71-24319*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
PROBABILISTIC SYSTEMS MODELING AND COST/PERFORMANCE METHODOLOGIES FOR OPTIMIZATION VEHICLE ASSIGNMENT. VOLUME 1: TECHNICAL DESCRIPTION Final Report
31 Mar. 1971 77 p refs
(Contract NAS2-5202)
(NASA-CR-114284) Avail: NTIS CSCL 22B

The optimal, least cost assignment of launch vehicles and related program elements for a total space program over an extended time period requires the solution of a large combinatorial problem. The conversion of this comprehensive space program evaluation to a probabilistic model is described. The developed computer model retains the capability for deterministic solutions but adds a new, powerful dimension for probabilistic evaluations and sensitivity analyses. With statistical data input, the program outputs program costs quantified to any degree of certainty. The input/output structure is versatile with multiple options for adaptation. Using one option, output results are smoothed under variable year-to-year budget constraints which reflect external economic conditions including growth and inflation. The developed technique and basic model can be adapted to other optimal assignment problems by particularizing the parameters to the new problem. Author

N71-24320*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
PROBABILISTIC SYSTEMS MODELING AND COST/PERFORMANCE METHODOLOGIES FOR OPTIMIZATION OF VEHICLE ASSIGNMENT. VOLUME 2: PROGRAMMER'S MANUAL, ASSIGNMENT AND SMOOTHING MODEL Final Report
31 Mar. 1971 193 p
(Contract NAS2-5202)
(NASA-CR-114285) Avail: NTIS CSCL 22B

A programmer's manual for the probabilistic optimal assignment and budget smoothing model is reported. Appendixes that provide model input requirements, a sample case, flow charts, and a program listing are included. At the beginning of each appendix, descriptive details and technical comments are provided to indicate any special instructions applicable to the use of that appendix. In addition, the program listing of appendix D includes comment cards that state the purpose of each subroutine in the complete program and describe operations performed within that subroutine. Appendix A, input requirements, provides details on the many options that adapt the program to the specific needs of a particular problem. Author

N71-24335*# Teledyne Brown Engineering, Huntsville, Ala. Science and Engineering Div.
A METHOD FOR COMPUTATION OF METEOROID IMPACT DISTRIBUTION OVER SPACECRAFT
T. Fu Feb. 1971 71 p refs
(Contract NAS8-20073)
(NASA-CR-103102; TN-SE-301) Avail: NTIS CSCL 22A

A method is described for the evaluation of the meteoroid flux distribution over external surfaces of a space system. A computer program was developed for calculating the number of particles and the angular distribution of impacts over a specific surface. The computer program is based on the application of numerical integration methods. Partial or complete blockage of one surface by another is considered in the formulation. The results of a sample problem are given in the report; these results are compatible with heat transfer view factor predictions. Author

N71-24336*# National Aeronautics and Space Administration, Washington, D.C.
SAN MARCO-C: PRESS KIT
18 Apr. 1971 14 p
(NASA-News-Release-71-63) Avail: NASA Scientific and Technical Information Facility, P. O. Box 33, College Park, Md. 20740 CSCL 22A

Pertinent information is presented regarding the scheduled launching of San Marco-C, the third spacecraft in a joint Italian-U.S. cooperative space program. The 360-pound scientific spacecraft carries three specially designed instruments to study the environment of the upper atmosphere in the equatorial region. The primary scientific objectives of San Marco-C are to obtain atmospheric drag, density, neutral composition, and temperature data to enable scientists to better understand the complex mechanisms affecting the upper atmosphere and develop a more accurate model. The scientific results obtained by the spacecraft will be deposited in the National Space Science Data Center for use by the world scientific community. D.L.G.

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N71-23138# Oak Ridge National Lab., Tenn.
TENSILE AND IMPACT PROPERTIES OF THICK-SECTION PLATE AND WELDMENTS
D. A. Canonico and R. G. Berggren Jan. 1971 30 p refs Presented at the Symp. on the Technol. of Pressure Retaining Steel Components, Vail Village, Colo., 21 - 23 Sep. 1970
(Contract W-7405-eng-26)
(ORNL-TM-3211; CONF-700935-2) Avail: NTIS

Most nuclear pressure vessels are fabricated from ASTM A533, grade B, class 1 steel plate. This steel is quenched and tempered in order to obtain its optimum properties in section sizes from 6 to 12 in. in thickness. The quench-and-temper heat treatment results in a variation in mechanical properties through the thickness of the plate. The room-temperature ultimate tensile strength varies from nearly 97,000 psi at the plate surface to about 89,500 psi at the midsection (1/2 T). The 30 ft-lb Charpy V-notch temperature varies from −150 F at the surface to +10 F at the 1/8 T location. Three welding processes are employed in the fabrication of the pressure vessels. These are the submerged arc process, the shielded metal-arc process, and the electroslag process. Their ultimate tensile strengths are all similar, about 80,000 to 85,000 psi. The impact properties of the electroslag and multipass weldments are not similar. The electroslag and weld metal has an upper shelf Charpy V-notch energy of about 80 ft-lb, whereas the multipass welds (subarc and shielded metal-arc) have shelf values of from 120 to 150 ft-lb. Author (NSA)

N71-23187+ National Aerospace Lab., Amsterdam (Netherlands).
DESCRIPTION OF THE EQUIPMENT FOR THE FATIGUE TEST ON THE WING OF THE FOKKER F28 FELLOWSHIP
R. Noback Nov. 1969 75 p refs
(NLR-TR-70008-L) Avail: NTIS

The wing of the Fokker F 28 Fellowship was fatigue tested. Before the actual testing started the equipment was tested on a dummy test rig. Different types of networks for stabilizing the systems were evaluated. Considerations which led to the choice of the loading systems are given together with a full description of the test equipment, including the protective system. The accuracy of the wing test is discussed. An analysis is given of two loading systems, especially of the influence of the coupling between these systems. Author

N71-23162# Gulf General Atomic, San Diego, Calif.
INSTANTANEOUS AND TIME DEPENDENT COLLAPSE OF EXTERNALLY PRESSURIZED CIRCULAR TUBES WITH INITIAL OUT-OF-ROUNDNESS
D. R. Buttemer 6 Nov. 1970 32 p refs Revised
(Contract AT(04-3)-167)
(GAMD-8219-Rev) Avail: NTIS

The collapse characteristics of externally pressurized circular tubes with an initial out-of-roundness were investigated analytically. A computer program was developed to calculate the pressure required to instantaneously collapse a tube with an initial out-of-roundness as well as to determine the time to cause collapse at operational conditions due to progressive creep deformation. Both primary and secondary creep were considered and the computer program had both Hastelloy-X and Type 316 stainless steel creep data built into it as functions of temperature and stress level. An option is also available that allows other materials to be investigated if their creep properties are known. Results of a case representative of a GCFR fuel-rod application are included. Author (NSA)

N71-23163# Bettis Atomic Power Lab., Pittsburgh, Pa.
FRACTURE MECHANICS EVALUATION OF STRESS INTENSITY FACTORS FOR VARIOUS CRACK GEOMETRIES AND LOADING CONDITIONS
S. J. Bhatt Dec. 1970 79 p refs
(Contract AT(11-1)-Gen-14)
(WAPD-TM-976) Avail: NTIS

More recent references on fracture mechanics solutions, limited to plane strain are summarized. Emphasis was placed upon solutions for various flaw geometries and arbitrary stress fields. The crack geometries analyzed and treated are straight-line cracks in plane bodies and circular flaws, parabolic flaws, and elliptical flaws in three-dimensional bodies. A variety of loadings are treated, including uniform stress, concentrated body forces, bending moments, and those arising from specified crack surface temperature or uniform heat fluxes. A method for approximating the stress intensity due to a flat circular or an elliptical flaw subjected to a non-uniform normal stress is also presented. Author (NSA)

N71-23197*# Fabric Research Labs., Inc., Dedham, Mass.
EFFECT OF STRAIN RATE AND LOAD CYCLING ON THE TENSILE BEHAVIOR AND AIR PERMEABILITY OF A COATED FABRIC
J. Skelton and N. J. Abbott [1970] 70 p refs
(Contract NAS1-9816)
(NASA-CR-111883) Avail: NTIS CSCL 20K

The tensile behavior and air permeability of a lightweight Viton-coated Nomex fabric were determined after exposure to various levels of cyclic stress applied at a range of strain rates. Specimens were stressed uniaxially to failure, and also to 25%, 50% and 75% of their failure load for one and ten cycles of stress, at strain rates of 1, 10, 100, 1000 and 10,000%/sec; specimens were stressed biaxially at approximately 1%/sec to similar load levels. The uniaxial tensile behavior was shown to be relatively insensitive to strain rate. The air permeability of the fabric was very low under all conditions of prestress and measurement load. This result is in contrast to previously obtained data for a similar coated fabric. It is suggested that the difference between the two fabrics is related to a critical level of coating material add-on. This level is the amount of coating required to fill all the interstices and to provide, in addition, a continuous coherent layer over the fabric surface. Author

N71-23309# Naval Ship Research and Development Center, Washington, D.C.
COMPUTER PROGRAM FOR CORRECTION OF BOUNDARY LAYER PRESSURE FLUCTUATIONS FOR HYDROPHONE SIZE AND BOUNDARY LAYER THICKNESS EFFECTS, OPTION 1
Ralph C. Leibowitz and Dolores R. Wallace Sep. 1970 36 p refs
(AD-718815; NSRDC-2976) Avail: NTIS CSCL 20/11

The validity of the Lyamshev-Salosina method of obtaining a universal curve of turbulence pressures in dimensionless parameters is verified, on the whole, by applying it to several sets of available data. The method introduces a correction to include the effect of the boundary-layer displacement thickness as well as the transducer size. Based on this confirmation, a more accurate formulation is proposed for mathematical models representing the observed pressure statistics. Then, using the Maestrello original formulation for the observed pressure statistics and the revised formulation developed, computer results (Option 1) are compared for both the power spectrum of the turbulent wall pressures and for the mean square of the displacements. Finally, the general effect of transducer size on the pressure model and corresponding vibroacoustic response is analytically investigated. Author (GRA)

N71-23330# Naval Civil Engineering Lab., Port Hueneme, Calif.
COMPARATIVE SOLUTIONS FOR THE RESPONSE OF RESTRAINED, RIGID-BODY UNDERWATER STRUCTURES TO ACOUSTIC SHOCK Final Report, Nov. 1969–Aug. 1970
J. G. Hammer and H. S. Zwibel Oct. 1971 77 p refs
(AD-718328; NCEL-TN-1141) Avail: NTIS CSCL 13/3

The report describes the problem of predicting the response of fixed underwater structures to a shock wave propagating through the water. Two idealized structures are considered; an elastically-restrained rigid sphere and an elastically-restrained rigid cylinder. The shock is assumed to be an exponentially-decaying pressure pulse in an acoustic fluid. Solutions to the exact equations are obtained analytically for the spherical structure and by Bellmans numerical inversion procedure for both structures. Previously obtained solutions for the restrained cylindrical structure, simplified by the Mindlin-Bleich approximation, are found to be in agreement. Response curves are given for both structural types over a range of parameters. The effects of drag are discussed. Author (GRA)

N71-23494# Pennsylvania State Univ., University Park.
BOUNDARY LAYER METHODS IN LINEAR COUPLE STRESS ELASTICITY
K. H. Chang and Craig Comstock 1 Jan. 1971 31 p refs
(Grant AF-AFOSR-1626-69)
(AD-717884; TR-1; AFOSR-TR-71-0053) Avail: NTIS CSCL 20/11

Boundary layer techniques, familiar in the context of fluid mechanics, are applied to two-dimensional couple-stress theory of linear elasticity. The existence of a boundary layer is established, and it is shown that in the interior the solutions approach rapidly the corresponding solutions of the classical elasticity theory. The practical application of the method is illustrated for simple shear and Lame-type problems. Author

N71-23495# Institut fuer Chemie der Treibstoffe, Berghausen (West Germany).
ROCKET BOOSTER INTERIOR BALLISTIC PROBLEMS. STRESS AND DIMENSIONING OF CIRCULAR SHELLS UNDER INTERNAL PRESSURE AND THERMAL SHOCK [INNENBALLISTISCHE PROBLEME BEI

RAKETENTRIEBWERKEN. BEANSPRUCHUNG UND DIMENSIONIERUNG VON KREISRUNDEN HOHLZYLINDERN BEI EINER INNENDRUCKBEANSPRUCHUNG UND EINER SCHOCKARTIGEN THERMISCHEN BELASTUNG]

W. Steinhilper 4 Dec. 1969 54 p refs In GERMAN
(ICT-14/69) Avail: NTIS

The temperature distribution in the wall of a combustion chamber is calculated for the case of internal thermal shock and outside insulation. The chamber is regarded as a cylindrical shell, and calculations are performed assuming validity of the laws of elasticity. The dependence of stress distributions on the chamber radius and the wall thickness is demonstrated. ESRO

N71-23733*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

BUCKLING LOAD OF THIN CIRCULAR CYLINDRICAL SHELLS FORMED BY PLASTIC EXPANSION

Le Roy R. Guist Washington Apr. 1971 11 p refs
(NASA-TN-D-6322; A-3733) Avail: NTIS CSCL 20K

An experimental investigation was made to determine the axial buckling load of cylinders formed by a process of plastic expansion due to internal pressure. Test cylinders 21.6 cm in diameter, 0.330 mm thick, were formed by plastic expansion from 15.23 cm diameter commercial, welded, type 304 stainless steel tubing. Buckling loads from 50 to 71 percent of the classical value showed a definite relationship with the local decrease in curvature due to the worst imperfections. Buckling loads were substantially higher than expected in relation to the amplitude of their geometric imperfections. The results indicate that the process of plastic expansion may provide a means of producing certain types of cylinders of unusually high buckling load at low cost. Author

N71-23734*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

THERMAL BUCKLING ANALYSIS FOR STIFFENED ORTHOTROPIC CYLINDRICAL SHELLS

L. K. Chang and Michael F. Card Washington Apr. 1971 88 p refs
(NASA-TN-D-6332; L-7021) Avail: NTIS CSCL 20K

A theory for thermal buckling of an orthotropic, multilayered, stiffened cylindrical shell is presented. The theory includes the effects of eccentricity of layers and stiffening, and deformations prior to buckling. It is sufficiently general to account for discrete rings and averaged properties of longitudinal stiffening, as well as arbitrary temperature distributions through the thickness of the shell and depth of the stiffeners. Two computer programs are described corresponding to solutions for buckling obtained by using finite differences and determinant plotting or modal iteration. Computed results for thermal buckling of unstiffened and ring-stiffened shells are presented and are in reasonable agreement with published results. The interaction of thermal loading and axial compression in two large-diameter stiffened shells representative of a launch vehicle interstage and a preliminary supersonic transport fuselage design is investigated. Results indicate that buckling can occur in both structures at a realistic temperature under thermal loading alone. Author

N71-23834 National Lending Library for Science and Technology, Boston Spa (England).

STATISTICAL ANALYSIS OF THIN WALLED METAL VESSELS AND PIPELINES: LINE LOADING

V. Krupka Feb. 1971 27 p Transl. into ENGLISH from the publ. 'Vypocet Valcovych Tenkostennych Kovovych Nadob A Potrubi' Prague, 1967 p 106-127
(NLL-RTS-6304) Avail: Natl. Lending Library, Boston Spa, Engl.: £2.50; 7 NLL photocopy coupons

A mathematical discussion of line loading an unstiffened shell is presented. The general case of line loading, the influence of loading for an infinitely long shell, and modifications for a shell of finite length are discussed. Stress calculations, and the influence of different lengths of support and different methods of support on stress magnitude at point of loading are also described. N.E.N.

N71-23903# Brown Univ., Providence, R.I. Engineering Div.

SURFACE WAVES GUIDED BY A SLIT IN AN ELASTIC SOLID

L. B. Freund Jan. 1971 29 p refs
(Contract ARPA SD-86)
(AD-718372; ARPA-E75) Avail: NTIS CSCL 20/11

Wave propagation in an isotropic elastic solid containing a slit is studied. The slit is viewed as an open crack of finite width and infinite length. In particular, the propagation of surface waves on the faces of the slit is considered. Making use of a reflection law for the oblique reflection of a Rayleigh wave from the tip of an open half plane crack, surface waves are superimposed to form guided surface waves in the slit. In order to carry out the construction of dispersion relations, an assumption on the rate of decay of body wave modes localized in the vicinity of the edges of the guide is made, and the range of validity of the assumption is discussed. The dispersion relations are obtained by geometrical construction, and representative dispersion curves are shown. Author (GRA)

N71-23913# Aerospace Corp., San Bernadino, Calif.

SHOCK FORMATION AND PULSE ATTENUATION IN A NONLINEAR, GEOMETRICALLY DISPERSIVE SOLID
Technical Report, Dec. 1969 - Oct. 1970

P. J. Rausch 5 Feb. 1971 52 p refs
(Contract F04701-70C-0059)
(AD-718411; TR-0059(S6816-75)-1; SAMSO-TR-71-27) Avail: NTIS CSCL 20/11

A generalization of the effective stiffness theory of Herrmann and Achenbach is used with weak shock theory to derive a set of approximate equations describing the propagation of a stress pulse in a nonlinear, geometrically dispersive material. The purpose of this investigation is to determine the effect of an interaction between these mechanisms on shock formation and pulse amplitude attenuation. The nonlinearity which is considered is that due to an increase with increasing stress in the materials bulk modulus. Both step wave and rectangular wave boundary pressure histories are considered. By using a coordinate perturbation technique, a first order solution is found. This solution describes the first order effect of dispersion on shock formation and propagation but not the effect of nonlinearity on the solution for the state variables which describe the dispersing wave. Author (GRA)

N71-23914# Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.

VARIATIONAL FORMULATION OF FINITE DISPLACEMENT ANALYSIS

Theodore H. H. Pian and Pin Tong 26 Jan. 1971 37 p refs Presented at Colloq. of the Intern. Union of Theoret. Appl. Mech. (IUTAM) on High Speed Computing of Elastic Struct., Liege, 23-28 Aug. 1970
(Contract F44620-67-C-0019)
(AD-717958; ASRL-TR-144-5; AFOSR-70-2722-TR) Avail: NTIS CSCL 20/11

Derivations of several variational principles for the incremental large deformation problems are made based on the second variation of the variational functionals. Finite element analyses using improved incremental solution procedures are then established. Included as examples are applications to the large deflection solutions of a low arch and shell of revolution under lateral pressure loadings. For the latter problem of the formulation is based on a mixed model using Reissners theory of axisymmetric shells. Author (GRA)

N71-23970+ Indian Inst. of Science, Bangalore. Dept. of Aeronautical Engineering.

VIBRATION OF ORTHOTROPIC SKEW PLATES

P. S. Nair and S. Durvasula Jan. 1970 21 p refs
(AE-264-S) Avail: NTIS

The vibration problem of orthotropic skew plates with different edge conditions involving simple support and clamping is considered using Rayleigh-Ritz method employing a double series of beam characteristic functions appropriate to the combination of the edge conditions. The results obtained for natural frequencies of clamped plates are presented. Features like frequency crossings as found in the case of isotropic plates are also observed in the case of orthotropic plates. Author

N71-23971* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
MEANS FOR SUPPRESSING OR ATTENUATING BENDING MOTION OF ELASTIC BODIES Patent
James C. Howard, inventor (to NASA) Issued 26 Nov. 1968 (Filed 27 Jul. 1966) 5 p Cl. 244-77
(NASA-Case-XAC-05632; US-Patent-3,412,961; US-Patent-Appl-SN-568355) Avail: US Patent Office CSCL 20K

A system for attenuating or suppressing bending motion in an elastic body is described. Signals proportional to the bending acceleration, velocity and displacement of the body are utilized to control the generation of forces which are applied to the body to modify its effective bending mass, damping and stiffness, and thus modify its vibration characteristics. Rigid-body motion components are eliminated from the signals so that the bending signals are uncontaminated. Official Gazette of the U.S. Patent Office

N71-23972# Braun (C. F.) and Co., Alhambra, Calif.
ISOCHRONOUS STRESS STRAIN CURVES FOR 2 1/4 CR-1 Mo, TYPE 304-304H, AND TYPE 316-316H STEELS, PART 1
16 Oct. 1970 37 p refs Prepared for United Nuclear Corp.
(Contract AT(04-3)-781)
(SAN-781-2012-Pt-1) Avail: NTIS

A method of depicting the time-dependent strain behavior of materials that is convenient for the design engineer is in the form of plots showing the variation of stress with strain for fixed time; the resulting curves have come to be called isochronous stress-strain curves. Consideration is given to possible methods of developing isochronous stress-strain curves appropriate for relatively long service life in pressure vessel and similar applications, and the conclusion is drawn that at the present time the only practicable approach is to compute them from creep intercept and creep rate data. Author

N71-23975# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON WAVE PROPAGATION IN A CYLINDRICAL SHELL
S. G. Saksonov 1971 4 p refs Transl. into ENGLISH from Prikl. Mekh. (Ukrainia, SSR), v. 7, no. 1, 1971 p 124-128
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

A numerical analysis of wave propagation in cylindrical shells is presented. In the method described, the three dimensional problem of elasticity theory is reduced to the two dimensional problem of shell thereby applying the general dynamics equation. Author

N71-23981# Naval Civil Engineering Lab., Port Hueneme, Calif.
WINDOWS FOR EXTERNAL OR INTERNAL HYDROSTATIC PRESSURE VESSELS. PART 5: CONICAL ACRYLIC WINDOWS UNDER LONG-TERM PRESSURE APPLICATION OF 10,000 PSI Final Report, Jul. 1969 - Jun. 1970
J. D. Stachiw and W. A. Moody Jan. 1971 85 p refs
(AD-718812; NCEL-TR-708-Pt-5) Avail: NTIS CSCL 13/13

Conical acrylic windows of 30-, 60-, 90-, and 120- and 150-degree included angle and 0.500 to 1.250 t/D (thickness to minor diameter ratio) have been subjected in their mounting flanges to 10,000 psi of hydrostatic pressure for 500 and 1,000 hours at ambient room temperature. The displacement of the windows through the flange mounting has been recorded as a function of time and plotted for the ready reference of the designer. The magnitude of the window displacement has been found to be a function of time, angle, temperature, t/D ratio and pressure. It is recommended that for safe single sustained operation of 1,000 hour duration at 10,000 psi hydrostatic loading at ambient temperature the windows should have an included conical angle less than 90 deg and a minimum t/D ratio of 0.750. For sustained loadings in excess of 1,000 hours the minimum t/D ratio is 1.000. Author

N71-23984 Houston Univ., Tex.
AXISYMMETRIC STRESSES AND DISPLACEMENTS IN A FINITE CIRCULAR BAR
Leonard Douglas Power (Ph.D. Thesis) 1969 52 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 70-9851

A class of axisymmetric boundary value problems for a finite solid circular bar is considered. The lateral surface is assumed to be traction free, whereas its end sections are subjected to prescribed tractions and/or displacements. The solution utilizes Love's stress function to generate a family of biorthogonal eigenfunctions on the interval (0,1). The problem is formally reduced to an infinite system of linear algebraic equations, explicit expressions being given in the case of mixed boundary conditions on both ends, or all boundary conditions prescribed on a single end. Dissert. Abstr.

N71-23985 New Mexico Univ., Albuquerque.
RANDOM VIBRATION OF PIECEWISE LINEAR SYSTEMS EXCITED BY NONSTATIONARY SHOT NOISE
Hsiang-Yueh Yeh (Ph.D. Thesis) 1969 74 p
Avail: Univ. Microfilms: HC $4.00/Microfilm $3.00 Order No. 70-10139

A general solution is presented for computing the transition probability of a piecewise linear system subjected to nonstationary excitation. In particular, analytical solutions are obtained for the transition probability of a first-order trilinear system excited by nonstationary Gaussian shot noise. White noise representation of the excitation which is a special case of shot noise is also considered. The mean and mean-square functions of the responses for these cases are computed and their results are also given graphically. Dissert. Abstr.

N71-24000# Texas A and M Univ., College Station. Inst. of Statistics.
NONLINEAR ANALYSIS OF ANISOTROPIC SHELLS OF REVOLUTION
R. E. Martin and Dan Drew Jan. 1971 29 p refs
(Contract N00014-68-A-0140; Proj. THEMIS)
(AD-718837; THEMIS-TR-27) Avail: NTIS CSCL 20/11

The paper deals with the solution of a set of nonlinear, second order, differential equations that describe an anisotropic shell of revolution. The analysis is based upon Sanders nonlinear shell theory. The method for solving these equations follows the procedure used by Budiansky and Radkowski. The equations are uncoupled by treating the nonlinear terms as known quantities, or psuedo loads, and a Gaussian elimination procedure is used to obtain the solution. This solution is used to calculate the nonlinear terms and entered into the system as a revised estimate of the psuedo load. This iterative procedure continues until the solution converges. Author (GRA)

N71-24116*# Scientific Translation Service, Santa Barbara, Calif.
THE DEFORMATION OF A ROADWAY, ELASTICALLY BEDDED WITHOUT LIMIT ON BOTH SIDES, BY LOADS WITH CONSTANT HORIZONTAL VELOCITY [DIE VERFORMUNG EINES BEIDERSEITS UNBEGRENZTEN

ELASTISCHGEBETTETEN GELEISES DURCH LASTEN MIT KONSTANTER HORIZONTALGESCHWINDIGKEIT]
Kondrad Ludwig Washington NASA Apr. 1971 16 p refs Transl. into ENGLISH from Proc., 5th Intern. Congr. for Appl. Mech., Cambridge, Mass., 1938 p 650–655
(Contract NASw-2035)
(NASA-TT-F-13619) Avail: NTIS CSCL 13B

A theory for the response of an elastic track (road) to a moving load is derived. Load velocities smaller and larger than the disturbance propagation velocity are considered. Several types of track support are treated. Author

N71-24117# Lockheed Missiles and Space Co., Palo Alto, Calif.
PROBLEMS OF SHELL INTERACTION WITH A FLUID
E. I. Grigoliuk 1970 31 p refs Transl. into ENGLISH from Tr. 7 Vseoiuznoi Konf. po Teorii Obolochek i Plastinok (Moscow), 1970 p 755–778
Avail: NTIS: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Vibration of shells partially filled with a heavy fluid and the dynamical reaction of shells under impact in an acoustic medium are discussed. The natural frequencies and modes of the vibrations of the elastic structure fluid system are described. Various theories to support the experimental results and numerical analyses are presented. Author

N71-24118 Lehigh Univ., Bethlehem, Pa.
REINFORCEMENT PHENOMENA IN SILICA-FILLED SILICONE ELASTOMERS
Anthony Vincent Galanti (Ph.D. Thesis) 1969 215 p
Avail: Univ. Microfilms: HC $9.70/Microfilm $3.00 Order No. 70-10598

Several series of silica-filled silicone vulcanizates were investigated using combined mechanical, swelling, and optical studies in an effort to elucidate the mechanisms responsible for reinforcement of these elastomers. The internal energy component of the stress has been derived from rigorous thermodynamic analyses of thermoelastic data for gum elastomers; a major portion of this research was devoted to the application of a similar analysis to determine the energetic contribution in filled silicone rubbers. These thermoelastic studies have shown that the energetic stress component of the total retractive stress increased significantly with certain fillers. The magnitude of this energetic contribution was related to the degree of rupture tensile, modulus, and swelling reinforcement for several silica fillers. These results indicated that the entropic retractive force due to chemical cross-links in the filled vulcanizates may be nearly invariant; on this basis, theoretical equations of state which incorporate a general energetic contributory factor were proposed for filled elastomers. Dissert. Abstr.

N71-24119 Stanford Univ., Calif.
DYNAMIC AND EIGENVALUE ANALYSIS OF STOCHASTIC STRUCTURAL SYSTEMS
Masaru Hoshiya (Ph.D. Thesis) 1969 146 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 70-10466

Dynamical response quantitites, such as eigenvalues and deflections of structural systems with material, geometric dimensions, boundary conditions and external loadings having probabilistic distributions are presented. In particular, vibration characteristics of a beam-column and a plate are investigated. Random perturbation technique is used for both the systems. For the beam-column problem, the general stochastic equations of the mean, the mean square and the variance for nth natural frequency are obtained when the material properties, the geometric properties, axial load and boundary conditions are probabilistic. Then the sensitivity analyses between the input parameters and the output parameters are investigated. The relative effects of uncertainty in input parameters such as axial load and structural properties with uncertainty in output parameters of natural frequency are studied. Dissert. Abstr.

N71-24120 Lehigh Univ., Bethlehem, Pa.
A STUDY OF FATIGUE AND FRACTURE IN PLATES AND SHELLS
John James Kibler (Ph.D. Thesis) 1969 252 p
Avail: Univ. Microfilms: HC $11.50/Microfilm $3.25 Order No. 70-10605

Several asymptotic solutions for the singular stresses near a crack in shallow, linear-elastic shells were extended to exact solutions which are valid for a wide range of shell parameters and crack lengths. In particular, the solutions of a longitudinal crack in a cylindrical shell and a crack in a spherical shell are presented for the case of symmetric loading along the line of the crack. Since shell structures are, in general, subjected to biaxial stresses, an experimental study was conducted on 6061 T4 and 6061 T6 aluminum and plexiglas plates to determine if a biaxial state of stress affected the fatigue crack growth and fracture properties of plates. Experiments were conducted on pressurized 6061 T4 aluminum cylinders containing longitudinal cracks and on 6061 T4 aluminum plates of comparable thickness. The plates were subjected to both uniaxial and biaxial stresses to determine fatigue crack growth rates and critical values of the elastic stress intensity factor at fracture. Dissert. Abstr.

N71-24214 National Lending Library for Science and Technology, Boston Spa (England).
ELECTRICAL LOAD AND DEFLECTION MEASUREMENTS IN THE NOTCHED BAR IMPACT TEST [ELEKTRISCHE KRAFT- UND DURCHBIEGUNGSMESSUNGEN BEIM KERBSCHLAGVERSUCH]
Alfred Krisch et al 26 Oct. 1970 22 p refs Transl. into ENGLISH from Arch. Eisenhuettenw. (Duesseldorf), v. 41, no. 1, Jan. 1970 p 91–95
(NLL-M-20165-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 3 NLL photocopy coupons

Photographs were taken with the aid of an oscillograph showing bending force-time and bending force-deflection curves. It was found that the ratio between the oscillograph deflection and the load up to 2000 kg was practically linear. Only on the second shock wave does elastic and plastic deformation of the test piece occur. Author

N71-24240*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FRACTURE OF THIN SECTIONS CONTAINING THROUGH AND PART-THROUGH CRACKS
Thomas W. Orange, Timothy L. Sullivan, and Frederick D. Calfo Washington Apr. 1971 24 p refs
(NASA-TN-D-6306; E-5857) Avail: NTIS CSCL 20K

Current fracture mechanics theory is used to illustrate the effects of crack dimensions and material properties on fracture stresses for through-thickness and part-through cracks. The implications of the analysis for leak-before-burst design of pressure vessels are discussed. The applicability of plane-strain theory to surface cracks in thin metal sections was studied experimentally. Aluminum and titanium alloy sheet specimens were tested at cryogenic temperatures. The specimens contained surface cracks of various lengths and depths or through cracks in the same range of cracks lengths. The fracture tests indicate that when Irwin's plastic zone size was less than about one-tenth of the uncracked ligament depth (thickness minus crack depth), surface-crack fracture behavior was in agreement with plane-strain theory. When the plastic zone was greater than the ligament depth, fracture stresses for surface-crack specimens were very nearly the same as for specimens with through-thickness cracks of the same original length. Author

N71-24275 Washington Univ., Seattle.
POST BUCKLING RESPONSE OF STRUCTURES USING THE FINITE ELEMENT METHOD
Theodore Edmund Lang (Ph.D. Thesis) 1969 159 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 70-8422

Response of structures exhibiting bifurcation change of state from a pre-buckling to a post-buckling equilibrium configuration is studied using structural representations by finite elements. The pre-buckling, critical point, and initial post-buckling equilibrium conditions and stability are mathematically defined including variations depending upon the post-buckling stability and presence of load and geometric imperfections. The initial post-buckling state is evaluated for conservative, static systems by perturbation of the total incremental potential energy, expressed in terms of characteristic functions, from the point of critical load. The column and plate structures representing post-buckling stable configurations are evaluated for particular boundary conditions and imperfections, permitting comparison with corresponding classically analyzed structures. Stiffness matrices associated with higher order terms of the total potential energy for these element types are reported. Dissert. Abstr.

N71-24281*# National Aeronautics and Space Administration. Washington, D.C.
TRANSIENT LOADS FROM THRUST EXCITATION: SPACE VEHICLE DESIGN CRITERIA (STRUCTURES)
Feb. 1969 28 p refs
(NASA-SP-8030) Avail: NTIS CSCL 13M

Criteria and practices for the analysis of transient loads that arise from an engine's thrust excitation during normal prelaunch, launch, and flight operations are presented. The transient loads considered are those induced by the ignition or shutdown of solid- and liquid-propellant rocket engines, and include the influence of effects resulting from release mechanisms, launch-stand dynamics, stored elastic energy, and staggering. Author

N71-24282# National Aerospace Lab., Amsterdam (Netherlands).
THE EFFECT OF SECONDARY BENDING ON THE FATIGUE STRENGTH OF 2024-T2 ALCLAD RIVETED JOINTS
A. Hartman and J. Schijve ec. 1969 45 p refs
(NLR-TR-69116U) Avail: NTIS

Six types of riveted specimens invluding lap joints and single and double strap joints have been compared both in constant-load-amplitude tests and in program tests. In the program tests, based on a gust load spectrum, the endurance of the double strap joint specimens was about three times as long as that of the single lap joint and the single strap joint with low secondary bending stresses, and it was about ten times as long as the endurances of the joints with severe secondary bending stresses. The fatigue strength for $N = 10$ to the 7th power load cycles decreased by severe secondary bending in the specimens to about half the strength of the double strap joints. The relation between the calculated bending stresses and the fatigue strength was analysed with respect to design aspects. Author

N71-24283 Rensselaer Polytechnic Inst., Troy, N.Y.
CRACK PROPAGATION UNDER HIGH TEMPERATURE LOW CYCLE FATIGUE
Charles Brett Harrison (Ph.D. Thesis) 1969 167 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 70-11320

A fracture model is developed to predict the rate of crack propagation under high temperature low cycle fatigue. It is based on a unique application of the effects of creep rupture rather than fatigue damage. The basic parameters of the model are determined solely from smooth bar creep rupture and true stress-true strain testing. The fracture model relies on actual crack growth testing only to provide an estimate of the size of the crack tip plastic zone. The crack growth equation developed is shown to predict crack growth rates during zero to tension load-controlled cycling of 1 Cr-1 Mo-.25 V low alloy steel at 1000 F, plus both deformation-controlled and completely reversed load-controlled cycling. The results are presented in the form of a design criterion for use in component evaluation and defect disposition. Dissert. Abstr.

N71-24284 Columbia Univ., New York.
ON THE ANALYSIS OF STRUCTURAL DESIGN
John Joseph Farrell (Ph.D. Thesis) 1969 54 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 70-6968

The iterative procedure for fully stressed design is analyzed. Only trusses under one load condition are considered. It is found that the iterative design procedure optimizes a dual pair of linear programming problems. Moreover it is noted that a class of linear programming problems can be optimized by iterating in the manner of fully stressed design, and an iterative procedure for minimum weight design is suggested. Dissert. Abstr.

N71-24285* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
METHOD FOR LEAKAGE TESTING OF TANKS Patent
Ernst E. Seiler, inventor (to NASA) Issued 3 Sep. 1968 (Filed 23 Nov. 1966) 6 p Cl. 73-49.2
(NASA-Case-XMF-02392; US-Patent-3,399,574; US-Patent-Appl-SN-596735) Avail: US Patent Office CSCL 13D

A method of testing a large liquid containing tank for leaks by partially filling the tank with an apparatus, such as a piston, that forms alternating relatively narrow and large spaces between the sidewall of the tank and the periphery of the piston is described. Liquid is pumped through a conduit system against the bottom of the tank and the liquid flows upwardly through the relatively narrow and large spaces thus applying varying leak revealing pressures against the tank sidewall. Official Gazette of the U.S. Patent Office

N71-24293# Illinois Univ., Chicago. Dept. of Materials Engineering.
AN ASYMPTOTIC THEORY FOR NONHOMOGENEOUS ANISOTROPIC CYLINDRICAL SHELLS. PART 2: LAYERED SHELLS
O. E. Widera Mar. 1970 16 p refs
(Grant NSF GK-3665)
(Rept-70-3-Pt-2) Avail: Issuing Activity

The first approximation shell theory presented in Part I is applied to layered shells. The layers, each of which can be anisotropic with arbitrary orientation, can be randomly arranged and be of different thicknesses. The problem of a two layer cross-ply shell under uniform external pressure is solved. Author

N71-24294# Illinois Univ., Chicago. Dept. of Materials Engineering.
AN ASYMPTOTIC THEORY FOR NONHOMOGENEOUS, ANISOTROPIC CYLINDRICAL SHELLS. PART 1: DERIVATION
O. E. Widera Feb. 1969 27 p refs
(Grant NSF GK-3665)
(Rept-69-8-Pt-1) Avail: Issuing Activity

A first approximation theory for the unsymmetric deformation of non-homogeneous anisotropic, elastic cylindrical shells is derived by means of the asymptotic integration of the elasticity equations. For a homogeneous, isotropic material, the equations reduce to the Donnell equations. Author

N71-24295# Lockheed Missiles and Space Co., Palo Alto, Calif.
FINITE CYLINDRICAL SHELL IN A FLUID FLOW

V. N. Buivol 1971 6 p refs Transl. into ENGLISH from Prikl. Mekh (Ukrainia), SSR), v. 7, no. 1, 1971 p 43–48
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

A numerical analysis of the behavior of a finite cylindrical shell in a fluid flow is presented. The application of linearized hydrodynamics equations to the solution of the problem is described. Author

N71-24296 Arizona Univ., Tucson.
INELASTIC STRESS ANALYSIS OF SOLIDS
Melvin LeRoy Callabresi (Ph.D. Thesis) 1969 89 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 70-9940

A mathematical model for the analysis of inelastic arbitrary three-dimensional solid structural systems is presented. The general equations of the finite element method have been formulated from a differential point of view, and result in a set of simultaneous nonlinear first order ordinary differential equations. The fourth order Runge-Kutta integration scheme is used to solve these equations, and two solution methods are studied for the algebraic equations needed to implement the nonlinear solution. These two solution methods are the direct Gaussian elimination scheme and the iterative conjugate gradient scheme. The latter has a distinct advantage over the former in that the stiffness matrix for the system is not required to be formed explicity. In the case of arbitrary solids, the two methods are comparable in computer solution time, provided that the system of equations can not be banded. Dissert. Abstr.

N71-24297 Lehigh Univ., Bethleham, Pa.
ULTIMATE STRENGTH OF TRANSVERSELY AND LONGITUDINALLY STIFFENED PLATE GIRDERS
Chingmiin Chern (Ph.D. Thesis) 1969 169 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 70-10589

An analytical study is presented of the static ultimate strength of plate girder panels subjected to shear, bending, or a combination of shear and bending. Considered are transversely and longitudinally stiffened girders with a section having flanges of unequal area. Particular attention is given to the establishment of the failure mechanism of transversely stiffened girders. The ultimate strength of a girder panel is found to depend on the strengths of the web plate and the flanges. The static ultimate strength is assumed to be given by the following three contributions: (a) the beam action strength up to the load at which web buckling would theoretically occur, (b) the post-buckling tension field strength of the web, and (c) the frame action strength which is based on the formation of a panel mechanism with plastic hinges forming in the flanges. Dissert. Abstr.

N71-24298# National Aeronautical Establishment, Ottawa (Ontario).
FREE VIBRATIONS AND RANDOM RESPONSE OF AN INTEGRALLY STIFFENED PANEL
Mervyn D. Olson and Garry M. Lindberg Oct. 1970 121 p refs (LR-544; NRC-11855) Avail: NTIS

The free vibrations and random response to jet noise of an integrally-stiffened five-bay panel were studied both theoretically and experimentally. A finite element approach was used to represent the panel and the predictions were verified by measurements on a model panel integrally machined from solid aluminum stock. The comparison between predicted and measured vibration modes and frequencies revealed good correlation of frequencies while the correlation of mode shapes was only fair, especially for higher modes. The predicted models and frequencies were used in a modal analysis of the panel's response to jet noise with a consistent finite element method being introduced to calculate the required cross-spectral modal force terms. Quantitative agreement between predicted and measured RMS stresses and displacements was realized, whereas only qualitative agreement was obtained for the associated spectra. Author

N71-24306# Computer Sciences Corp., Los Angeles, Calif.
MEAN SQUARE EXCEEDANCE CHARACTERISTICS OF A SINGLE TUNED SYSTEM TO AMPLITUDE MODULATED RANDOM NOISE
Richard L. Barnoski and John R. Maurer Nov. 1970 167 p refs
Avail: NTIS

A general formulation is reviewed for an envelope modulation of arbitrary form and noise of arbitrary correlation. Three modulation functions and noise with a damped cosine correlation are treated. For correlated noise, the time-varying mean square response may exceed the stationary value by a factor in excess of two. Such exceedances do not occur for white noise. This behavior is summarized by parametric plots and explained in terms of a time-varying shaping filter. The input model is considered representative of gusts, earthquakes, initial ignition of boosters, and automotive vehicle impacts. The results thus bear directly on the design, analysis, and testing of structural systems in such nonstationary random environments. Author

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N71-23173# Los Alamos Scientific Lab., N.Mex.
ADIABATIC CALORIMETRIC ENTHALPY MEASUREMENTS FOR ALPHA, BETA, AND GAMMA URANIUM AND THE HEATS OF THE TRANSFORMATIONS ALPHA YIELDS BETA AND BETA YIELDS GAMMA
David G. Clifton Sep. 1970 13 p refs
(Contract W-7405-eng-36)
(LA-4521) Avail: NTIS

Enthalpy of the alpha, beta, and gamma phases of high-purity depleted U-238 was measured, and values for the heats of the alpha yields beta and beta yields gamma transformations were obtained. These measurements were made during development of an adiabatic calorimeter designed to measure heat effects on condensed-phase samples in the temperature range from about 500 to 1000 C. The calorimeter is described. Author (NSA)

N71-23196*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PREDICTION OF THE THERMAL CONDUCTIVITY ANOMALY OF SIMPLE SUBSTANCES IN THE CRITICAL REGION
R. C. Hendricks and A. Baron 1971 12 p refs Proposed for presentation at 12th Natl. Heat Transfer Conf., Tulsa, Okla., 15–18 Aug. 1971; sponsored by ASME and Am. Soc. of Chem. Engr.
(NASA-TM-X-52955; E-6266) Avail: NTIS CSCL 20M

The anomalous behavior of the thermal conductivity of five gases, carbon dioxide, argon, nitrogen, oxygen, and methane was investigated using the theoretical approach of Brokaw and the equation of state given by Bender. The analysis presented properly describes the trends in the data and in general is in good agreement with the data for the density/critical density ratio less than 1.1. The theory falls 10 to 15 percent above the data at higher densities and appears about 10 percent high in the peripheral regions. The results seem adequate for engineering calculations and useful in establishing the thermal conductivity behavior of fluids for which no data have yet been taken. Author

N71-23228# National Research Council of Canada, Ottawa (Ontario).
INITIAL STUDIES OF LOW TEMPERATURE ABLATION IN A HELIUM HYPERSONIC WIND TUNNEL
L. Elias, K. Ortik-Ruckemann, and D. L. Kohlman Albuquerque, N.Mex. Sandia Corp. Jan. 1971 61 p refs Prepared for Sandia Corp.
(SC-CR-69-3215) Avail: NTIS

Exploratory experiments were carried out at Mach 16.4 and at 600 psi stagnation pressure using (a) metal models at room temperature, (b) models with copper inserts, cooled to −140 C, and (c) models with carbon dioxide inserts. Surface temperature, surface recession rates and pitot pressure profiles were determined. Suitable model fabrication and experimental techniques were developed. A simple theoretical method of predicting recession rates and surface temperatures was proposed. It was demonstrated that the ablation of carbon dioxide into an unheated Mach 16.4 helium flow at 600 psi stagnation pressure is significant enough to result in measurable flat plate recession rates and measurable changes in pitot pressure profiles. In addition it was shown that it is possible to distinguish between the effects on pitot pressure of reduction in surface temperature and of mass addition through sublimation of carbon dioxide. It was also found that the first order theoretical analysis predicts proper trends and correct approximate magnitude of sublimation rates. Author

N71-23252# Naval Postgraduate School, Monterey, Calif.
HEAT TRANSFER IN FINITE SLABS
Donald Ray McNeil (M.S. Thesis) Dec. 1970 72 p refs
(AD-718332) Avail: NTIS CSCL 20/13

An analysis is made of temperature distributions in a slab of finite thickness and infinite extent, one surface of which is perfectly insulated and the other surface of which is exposed to a fluid the temperature of which varies in a specified way. Two cases are considered. In the first case, the temperature of the fluid is suddenly changed and maintained at the new value. In the second case of the temperature of the fluid increases linearly with time. From the solutions of these problems, curve sheets are developed which permit evaluating each of eight different problems, curve sheets are developed which permit evaluation each of eight different quantities of engineering significance. These curve sheets cover more cases of interest and are easier to use than simular curves which have appeared in the report literature. Author (GRA)

N71-23346*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THERMODYNAMICS OF ENVIRONMENTAL DEGRADATION
Robert F. Mueller Mar. 1971 15 p refs
(NASA-TM-X-65492; X-644-71-121) Avail: NTIS CSCL 20M

An overview is presented of the processes of environmental thermodynamics which are symptomatic of the general degradation of earth's natural realms, and an attempt is made to set forth the postulates which are regarded as necessary for a more detailed and quantitative analysis. D.L.G.

N71-23357# Institut fuer Chemie der Treibstoffe, Berghausen (West Germany).
PERFORMANCE CALCULATION OF ROCKET PROPELLANTS AND PROPELLANT CHARGE POWDERS [LEISTUNGSBERECHNUNG VON RAKETENTREIBSTOFFEN UND TREIBLADUNGSPULVERN]
F. Volk 30 Jun. 1970 54 p refs In GERMAN
(ICT-3/70) Avail: NTIS

The fundamental thermodynamic relationships for the calculation of equilibrium combustion of a propellant system consisting of carbon, hydrogen, nitrogen, oxygen, chlorine, and aluminum are described. A FORTRAN program in Basic FORTRAN 4 was developed to determine the combustion efficiency of rocket propellants and explosives. ESRO

N71-23362# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Trauen (West Germany). Abteilungen Thermo- und Gasdynamik Feststoffsysteme.
THE APPLICATION OF THE LINE-REVERSAL-METHOD TO TEMPERATURE MEASUREMENT IN THE COMBUSTION CHAMBER OF A ROCKET ENGINE [DIE ANWENDUNG DER LINIENUMKEHRMETHODE ZUR TEMPERATURMESSUNG IN DER BRENNKAMMER EINES RAKETENTRIEBWERKES]
Harald Twardy and Horst Selzer Nov. 1970 48 p refs In GERMAN; ENGLISH summary
(DLR-FB-70-70) Avail: NTIS; ZLDI Munich: 12,20 DM

The experiences with the line-reversal-method to measure high gas temperature in a rocket motor are being used to modify this technique with the aim of reducing the data handling and also to increase the temperature region from now 3740 to 4940 K, theoretically. This could be done by using a small region of the arc of a high pressure xenon source for comparison and by developing a more efficient modulation device. Measurements were made in the combustion chamber of a liquid rocket motor near 3000 K. The influence of the different error sources on the overall error is discussed. Author (ESRO)

N71-23492# Princeton Univ., N.J. Dept. of Aerospace and Mechanical Sciences.
PHYSICS OF FLAMES Final Report, 1 Jul. 1968–31 Jul. 1970
Irvin Glassman, William A. Sirignano, and Martin Summerfield Sep. 1970 252 p refs
(Contract DAAD05-68-C-0450)
(AD-718866; AMS-952) Avail: NTIS CSCL 20M

Theoretical and experimental analyses of flame spreading across pools of liquid fuels and the ignitability of such pool under quiescent and flowing environments are presented. The fundamental concept is that, when the temperature of the liquid fuel is below the flash point, convection currents in the liquid play a dominant role in both ignitability and flame spreading. These currents are induced by either or both surface tension and buoyancy forces. A theoretical analyses related to ignition of fuels by projectiles is presented. A brief section on the combustion of nitrocellulose-base propellants is included. Author (GRA)

N71-23512# Institut fuer Chemie der Treibstoffe, Berghausen (West Germany).
MEASUREMENT OF FLAME TEMPERATURE ALONG A ROCKET EXHAUST JET [MESSUNG DER FLAMMENTEMPERATUR ENTLANG EINES RAKETENABGASSTRAHLES]
R. Zapp 31 Dec. 1969 110 p refs In GERMAN
(ICT-12/69) Avail: NTIS

After discussing the various methods used to measure the flame temperature in rocket exhaust flames, the experimental design actually used is described. An incandescent high-temperature lamp is placed into a spherical mirror to provide a black body radiation source. The intensity of certain spectral lines from the flame and from the incandescent source is compared and the intensity of the incandescent source is adjusted to give zero difference. ESRO

N71-23712*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYTICAL AND EXPERIMENTAL STUDY OF COMPRESSIBLE LAMINAR FLOW HEAT TRANSFER AND PRESSURE DROP OF A GAS IN A UNIFORMLY HEATED TUBE
Alden F. Presler Washington Apr. 1971 45 p refs
(NASA-TN-D-6333; E-5702) Avail: NTIS CSCL 20M

Numerical solutions of the compressible laminar boundary layer equations are obtained to investigate acceleration effects due to wall heating on axial development of velocity and temperature

profiles, local Nusselt numbers, and especially static pressure drop and its momentum and frictional components. Heating, combined with compressibility, produces blunter velocity and temperature profiles than are reported in earlier analyses. Larger momentum pressure drops relative to friction losses reduce the Poiseuille pressure parameter by as much as one-third of its fully developed value. Experimental values of pressure drop and momentum-to-friction pressure ratio checks the analytical predictions. Author

N71-23713*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LONGITUDINAL INSTABILITY LIMITS WITH A VARIABLE LENGTH HYDROGEN OXYGEN COMBUSTOR
C. Joe Morgan and Daniel E. Soko Washington Apr. 1971 21 p
(NASA-TN-D-6328; E-5759) Avail: NTIS CSCL 20M

An experimental investigation determined the longitudinal-mode instability characteristics of a 10,000 pound thrust, 300 psi chamber pressure, hydrogen-oxygen engine that could be continuously stroked in length from 19 to 65 inches during operation. A baffle was used to inhibit the transverse modes. Increasing baffle length stabilized the longitudinal mode of instability. Decreasing the hydrogen-injection temperature was destabilizing. The data were analyzed with the sensitive time-lag theory to determine values of the interaction index and sensitive time lag at the stability boundaries. Author

N71-23906# Montana State Univ., Bozeman.
NATURAL CONVECTION HEAT TRANSFER BETWEEN CONCENTRIC SPHERES
J. A. Scanlan, E. H. Bishop, and R. E. Powe [1969] 33 p refs
(Contract AT(45-1)-2214)
(RLO-2214-2) Avail: NTIS

An experimental investigation is described concerning natural convection between two isothermal concentric spheres of various diameter ratios ranging from 1.09 to 2.81. The convecting fluids used were water and two silicone oils yielding Prandtl numbers in the range of 4.7 to 4148 and Rayleigh numbers, based on gap width, in the range of $1.3 \times 1,000$ to 5.8×10 to the 8th power. Measured temperature profiles are analyzed in detail with reference to five typical characteristics of the profile shapes. All features of the profiles are explained in terms of postulated convective flow patterns which represent extensions of work previously reported for air under similar conditions. A heat transfer correlation is presented for each of the three fluids individually, and an overall expression based solely on a modified Rayleigh number is presented which correlates all three liquids as well as air. The correlations fit the data with an average deviation of less than 16 per cent. Author

N71-23977# California Univ., Los Angeles. School of Engineering and Applied Science.
UNSATURATED HELIUM COOLING LIMITS. SUMMARY OF LIQUID HELIUM-4 BOUNDARY AND HEAT TRANSPORT STUDIES Final Report, Oct. 1967 - Oct. 1970
Christian Linnet, Vance Purdy, Y. W. Chang, and T. H. K. Frederking Oct. 1970 85 p refs
(Contract DAAK02-68-C-0064)
(AD-717568; UCLA-70-91) Avail: NTIS CSCL 20/13

The report summarizes studies of liquid He4-solid boundary conductances and liquid He4 cooling limits. Emphasis is on the final phase of the investigations concerned with cooling by means of unsaturated pressurized superfluid He II. Cooling limits arise from the destruction of superfluidity when He II locally is replaced by ordinary fluid. The limiting heat flux densities have been studied with a vacuum-insulated vertical tube (zero mass flow configuration), closed and heated at its lower end. The limiting heat flux densities were found to be a function of the system pressure and temperature. For a comparison, data have been taken also for saturated He II. The pressure range of the unsaturated liquid studies extended from 1 atm to supercritical pressures of about 3 atm. The temperature had a strong effect on the limiting heat flux density which increased toward a constant value of about 3 W/sq cm below 1.8 degrees K. In contrast to saturated He II studies, no maximum in the cooling limit was detected. The unsaturated liquid data exceeded those for saturated liquid by a factor of about 2. Theoretical calculations have been carried out for both, saturated and unsaturated liquid. Author (GRA)

N71-24089*# Translation Consultants, Ltd., Arlington, Va.
THE NATURE OF ELECTRIC FIELD EFFECT ON HEAT EXCHANGE IN FLUID DIELECTRICS [O PRIRODE VLIYANIYA ELEKTRICHESKIKH POLEY NA TEPLOOBMEN V ZHIDKIKH DIELEKTRIKAKH]
S. S. Kravets Washington NASA Apr. 1971 7 p refs Transl. into ENGLISH from the publ. 'Teploi Massoobmen v Khimicheskoy Tekhnologii' Kiev, Nauka Press, 1967 p 110-115
(Contract NASw-2038)
(NASA-TT-F-13560) Avail: NTIS CSCL 20M

The results of an investigation indicate: (1) that the intensification of heat exchange in a permanent electric field is the result of convection currents from the fluid around a heat exchange surface, and (2) that the intensification of heat exchange in an alternating electric field is the result of drawing cold fluid particles into the region of maximum intensity (temperature) and ejecting heated particles from the region into the fluid volume. Author

N71-24109# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering.
HEAT TRANSFER CHARACTERISTICS OF A ROW OF AIR JETS IMPINGING ON THE INSIDE OF A SEMICIRCULAR CYLINDER. PROJECT THEMIS
R. Ravuri and W. Tabakoff Jan. 1971 60 p refs
(Contract DAHC04-69-C-0016)
(AD-718794; THEMIS-AE-71-18; AROD-T-4-27-E) Avail: NTIS CSCL 20/4

Experimental results of average heat transfer coefficients for a row of air jets impinging on the inside of a semi-cylinder are presented. The variation of the average Nusselt Number with the wide range of Reynolds Numbers are found. Two semi-cylinder concave surfaces with different diameters, four different impinging jet configurations and variable impinging heights were investigated. The effect of introducing solid particles into the cooling air on the heat transfer performance was studied. Author (GRA)

N71-24110# Boston Coll., Chestnut Hill, Mass. Dept. of Chemistry.
STRUCTURE OF FLUORINE SUPPORTED FLAMES. 1: METHOD OF INVESTIGATION. THE DICHLORO-DIFLUOROMETHANE-FLUORINE FLAME
A. Hoffman, K. H. Homann, and D. I. Maclean Jan. 1971 21 p refs
(Contract N00014-69-A-0453)
(AD-718375; FRK-111) Avail: NTIS CSCL 21/2

The stoichiometric dichlorodifluoromethane-fluorine combustion reaction has been studied in a low pressure flame at 77 mm Hg. Concentration profiles across the reaction zone of the flame have been measured by a molecular beam sampling technique on a time-of-flight mass spectrometer. The reaction mechanism is proposed. Author (GRA)

N71-24148* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THERMAL RADIATION SHIELDING Patent
Ben T. Ebihara, inventor (to NASA) Issued 5 Nov. 1968 (Filed 17 Jun. 1966) 3 p Cl. 13-35
(NASA-Case-XLE-03432; US-Patent-3,408,730; US-Patent-Appl-SN-558345) Avail: US Patent Office CSCL 20M

Spaced radiation barriers of refractory metal foil which encircle

an induction furnace are described. A mat of refractory metal fibers maintain the spacing between these radiation barriers.
Official Gazette of the U.S. Patent Office

N71-24161*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF RADIOMETRIC ERRORS ON ACCURACY OF TEMPERATURE-PROFILE MEASUREMENT BY THE SPECTRAL SCANNING METHOD
D. R. Buchele [1971] 27 p refs Proposed for presentation at 5th Symp. on Temp.: *Its* Meas. and Control in Sci. and Ind., Washington, D.C., 21–24 Jun. 1971; sponsored by Am. Inst. Phys., Instr. Soc. Am., and NBS
(NASA-TM-X-67817) Avail: NTIS CSCL 20M

The spectral scanning method may be used to determine the temperature profile of a jet or rocket engine exhaust stream by measurements of gas radiation and transmittance, at two or more wavelengths. It is shown that the ratio between temperature error and radiometric error depends on profile shape, path length, temperature level, the strength of line absorption, and the absorption coefficient and its temperature coefficient. The conditions for minimum temperature error are derived, numerical results are presented for a two-wavelength measurement on a family of profiles that may be expected in a practical case of hydrogen oxygen combustion. Under favorable conditions, the fractional error in temperature approximates the fractional error in radiant flux measurement. For small path lengths, where gas absorptance is small, the temperature error may be minimized by choosing widely separated wavelengths. Author

N71-24198*# Scripta Technica, Inc., Washington, D.C.
THERMODYNAMIC STUDY OF THE REACTION OF TUNGSTEIN WIRES WITH OXYGEN AND CARBON DIOXIDES AT 1500-3500 K [THERMODYNAMISCHE UNTERSUCHUNG ZUR REAKTION VON WOLFRAMDRAHTEN MIT O2 UND CO2 BEI TEMPERATUREN ZWISCHEN 1500 UND 3500 K]
H. Schafer NASA Apr. 1971 29 p refs Transl. into ENGLISH from Z. Anorg. Allgem. Chem. (Leipzig), v. 376, no. 1, 1970 p 11–27
(Contract NASw-2036)
(NASA-TT-F-13546) Avail: NTIS CSCL 20M

A tungsten filament glows in an inert gas containing very small concentrations of oxygen (N2 + O2; CO + CO2), at atmospheric pressure. Filament temperatures range from 1500 to 3500 K. The following observations are explained on the basis of thermodynamic equilibria existing at the surface of the filament and involving the species O1, O2, W1, WO2, WO3, W3O9, W4O12: (1) The inversion of the direction of tungsten transport in a temperature gradient at about 2800 K; (2) the unusually sharp decrease in the amount of tungsten vaporized below 1600 K; and (3) the order of magnitude of tungsten vaporization. Author

N71-24199# Institut fuer Chemie der Treibstoffe, Berghausen (West Germany).
DIMENSIONING OF GRAPHITE INSERTS FOR ROCKET NOZZLES USING AN ELECTRIC ANALOGY MODEL [DIMENSIONIERUNG VON GRAPHITEINSAETZEN FUER RAKETENTRIEBWERKSDUESEN MIT HILFE EINES ELEKTRISCHEN ANALOGIE-MODELLS]
W. Steinhilper 15 Jun. 1970 43 p refs In GERMAN
(ICT-2/70) Avail: NTIS

An analog simulation method using electric circuits is described to determine the time dependence of the temperature distribution in the graphite protective coating of rocket nozzles. After describing the analogy between the thermal flow field and the electrical current field, the design of the electric models is described. The results of the experiments are discussed. ESRO

N71-24200*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THERMAL AND RADIATIVE PROPERTY MEASUREMENT OF THERMAL CONTROL COATINGS BY CYCLIC RADIATION
Ernie W. Spisz and John R. Jack Washington Apr. 1971 20 p refs
(NASA-TN-D-6316; E-6110) Avail: NTIS CSCL 20M

A technique is described and developed whereby the cyclic radiation method of determining thermal radiative properties is used to determine simultaneously the specific heat, absorptance, and emittance of thermal-control coatings. Data are presented for four white coatings (3M white, S-13G, Z-93, and Cat-a-lac white) and two black coatings (3M black and Cat-a-lac black) over a temperature range from approximately 150 to 300 K. An additional application of the cyclic radiation technique is illustrated by determining the specific heat of a 302 stainless steel sample by coating the sample with 3 M black coating and using previously measured properties of the coating as a reference. Author

N71-24201 Lehigh Univ., Bethlehem, Pa.
THE DEVELOPMENT AND STUDY OF A REMOTE THERMOCOUPLE METHOD TO MEASURE CUTTING TEMPERATURES IN PROCESS CONTROL MACHINING
Mikell Porter Groover (Ph.D. Thesis) 1969 192 p
Avail: Univ. Microfilms: HC $8.80/Microfilm $3.00 Order No. 70-10602

The results are presented of a study aimed at the development of a temperature measuring device specifically suited to use in production machining operations. Also investigated were alternative strategies for using temperature to economically control the machining process. The temperature measuring technique which was innovated in the study utilized the signals from two thermocouples located beneath the cutting tool insert. The seat in which the insert was located was fabricated out of a thermal insulating material. In this way, the temperatures at the two remote placements would reach higher values than if no insulation were used. A second feature of the measuring technique was that it employed an analog computer to perform on-line computation of the tool tip temperature from the two thermocouple signals. The remote thermocouple technique was investigated in several ways. It was determined by a series of cutting tests that the thermal insulation had no detrimental effect on tool wear. Several computer simulations of the heat transfer process in the cutting tool were conducted, and cutting tests were performed to verify the computer simulations.
Dissert. Abstr.

N71-24202*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECTS OF HIGH ACCELERATIONS AND HEAT FLUXES ON NUCLEATE BOILING OF WATER IN AN AXISYMMETRIC ROTATING BOILER
Paul J. Marto and Vernon H. Gray Washington May 1971 59 p refs
(NASA-TN-D-6307; E-6040) Avail: NTIS CSCL 20M

Stable boiling in a rotating cylindrical annulus with continuous through-flow of water was obtained at heat fluxes as high as 818,000 Btu/(hr)(sq ft) (2.58 MW/sq m) at atmospheric pressure. Incipient- and nucleate-boiling heat-transfer coefficients were obtained at accelerations up to 400 g's. Measurements were made of void fractions, radial temperature profiles, and wall pressures in the boiling fluid. Convective secondary-flow cells and fluid temperature inversions were revealed. Increased fluid thicknesses increased heat-transfer coefficients, but inlet liquid subcooling had no effect. Coefficients increased with acceleration at low heat fluxes, but at high fluxes varied less than the usual data scatter.
Author

N71-24235# California Univ., Livermore. Lawrence Radiation Lab.

SHOCK-PULSE ATTENUATION AND HUGONIOT STUDIES OF THREE EXPLOSIVES AND THREE MOCK EXPLOSIVES
Richard J. Wasley and Robert H. Valentine 12 Oct. 1970 20 p refs Sponsored by AEC
(UCRL-50950) Avail: NTIS

The mechanical responses of the solid high explosive LX-04-1 and three mock explosives, LM-04-0, RM-04-BG, and Teflon, were compared under conditions of both narrow-pulse and sustained-shock loading. The explosives LX-09-0 and LX-10-0 were investigated only under conditions of narrow-pulse loading. The pulse widths were nominally 0.1 microsec, and the stress levels were less than 20 kbar. The pulse studies gave data on the shock attenuation characteristics of the materials, and the sustained loading studies enabled unreacted Hugoniot information to be generated. The techniques included the use of flyer plates attached to special projectiles that were launched by a gun. Author

N71-24241*# National Aeronautics and Space Administration, Washington, D.C.
INVESTIGATION OF A SYSTEM OF ANNULAR HEAT CONDUCTING EMITTING RIBS [DOSLYDZHENNYA SISTEMI KYLTSEVIKH TEPLOPROVYDNYKH REBER. SOCHO BIPROMYNYUYUT]
G. L. Groozovskiy et al Apr. 1971 10 p refs Transl. into ENGLISH from Dopovidi Akad. Nauk Ukr. SSR (Kiev), no. 2, 1970 p 147–152
(NASA-TT-F-13551) Avail: NTIS CSC 20M

An emitting system, consisting of three identical thin and gentle annular ribs of variable thickness orthogonal to each other, is considered in a two-dimensional presentation intended for heat removal from the sphere. The rib surfaces are grey diffuse emitters. The environment is an absolutely black body at a zero temperature. In the case of ribs with absolutely black surfaces, an approximate solution of a problem of weight optimization in the class of ribs, in which temperature depends only on the radius and does not change in the azimuthal direction, is obtained by means of an electronic computer. Author

N71-24242*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AMPLIFICATION BY WAVE DISTORTION OF THE DYNAMIC RESPONSE OF VAPORIZATION LIMITED COMBUSTION
Marcus F. Heidmann Washington May 1971 39 p refs
(NASA-TN-D-6287; E-6049) Avail: NTIS CSCL 20M

Approximate analytical expressions are derived for the response of a vaporization limited combustion process to acoustic oscillations which have distorted wave shapes. Some exact numerical solutions are presented for comparison. The response is shown to be dependent on the type of distortion. For some conditions the response is an order of magnitude larger than that for sinusoidal wave shapes. The results imply that wave distortion could cause unstable combustion and should be considered in the design of rocket and jet engine combustors. Author

N71-24258# Kyoto Univ. (Japan). Research Inst. for Fundamental Physics.
EXACT SOLUTION OF THE ONE DIMENSIONAL HEISENBERG MODEL AT FINITE TEMPERATURE
Minoru Takahashi (Tokyo Univ.) Mar. 1971 31 p refs
(RIFP-116) Avail: NTIS

A set of integral equations which describes the thermodynamic properties of one-dimensional Heisenberg model is obtained. From these equations, calculations can be made of the energy, entropy, and magnetization of the system at given temperature and magnetic field. Author

N71-24276* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AUTOMATIC FATIGUE TEST TEMPERATURE PROGRAMMER Patent
Eugene C. Naumann and Patrick L. Corbin, inventors (to NASA) Issued 22 Oct. 1968 (Filed 26 Aug. 1966) 6 p Cl. 165-12
(NASA-Case-XLA-02059; US-Patent-3,406,742; US-Patent-Appl-SN-576182) Avail: US Patent Office CSCL 20M

A fatigue testing machine which accelerates testing and includes a furnace used for heating the test specimen positioned therein is reported. The sides of the furnace can be opened to enable cool air to be directed over the test specimen. A mechanism cyclicly loads the test specimen. The heating, cooling and loading of the test specimen is programmed so that the test specimen can be loaded under heated and cooled conditions as rapidly as possible until failure of the specimen. This makes it possible to gather data on the specimen in the least time possible. Official Gazette of the U.S. Patent Office

N71-24277# National Research Council of Canada, Ottawa (Ontario).
LIGHT SPARK AS A MINIATURE EXPLOSION [SVETOVAYA ISKRA-MINIATYURNYI VZRYV]
G. A. Askar'yan et al 1971 15 p refs Transl. into ENGLISH from Priroda (Moscow), no. 6, 1968 p 60–65
(NRC-TT-1450) Avail: NTIS

The breakdown, or the massive avalanche-like gas ionization in a strong field of light is studied. A rapid release of the energy of a laser pulse in the small volume of a focus in a short period of time (approximately 30 nsec) produces a light spark similar to a miniature explosion. The spark represents a small cloud of dense concentrated plasma, in which the concentration of electrons and the absorption of light increase very rapidly. It was found that the breakdown and the spark are produced in a gas only when the density of the radiation flux exceeds a certain threshold value. For the breakdown, this value depends on the type of gas and the pressure (the threshold intensity drops with increase in gas pressure). Author

N71-24278# Florida Univ., Gainesville. Engineering and Industrial Experiment Station.
APPLIED STATISTICAL THERMODYNAMICS OF FLUIDS OF NONSPHERICAL AND POLAR MOLECULES Terminal Report
J. P. O'Connell [1970] 12 p refs
(Grant NSF GK-3671)
Avail: Issuing Activity

The thermodynamic properties of fluids with nonspherical intermolecular forces have been expressed in perturbation expansions about the properties of spherical fluids using hard sphere radial distribution functions. Considered are the properties of dense gas normal paraffins as a preliminary to treating substances with more complex forces. Using smoothed potential parameters determined from fitting second virial coefficient data, initial calculations show that this generalization yields an accurate correlation of compressibility factors and enthalpies. Author

N71-24279# Bureau of Mines, Pittsburgh, Pa. Health and Safety Technical Support Center.
EXPLOSION DEVELOPMENT IN CLOSED VESSELS
John Nagy, Earl C. Seiler, John W. Conn, and Harry C. Verakis Apr. 1971 54 p refs
(BM-RI-7507) Avail: Issuing Activity

Data from experiments and literature on gas and dust explosions in closed vessels are presented to show the effects of the vessel size and shape, the initial pressure, temperature, and turbulence, the fuel-air ratio and the strength of ignition source on pressure and rate of pressure rise. An attempt is made to correlate some of these parameters with an elementary mathematical model.

Analyses of data on 17 vessels -- spherical, cubical, cylindrical, and rectilinear in shape -- ranging from 0.018 to 905 cubic feet in volume were made. Some data were obtained for gas explosions so that the factor of initial turbulence caused by the pneumatic blast used to disperse dust could be evaluated. Correlations obtained for several factors affecting explosion development show that neither vessel size nor shape affected maximum pressure (when heat loss was neglected.) Author

N71-24280# National Bureau of Standards, Washington, D.C. Physical Chemistry Div.

SELECTED VALUES OF CHEMICAL THERMODYNAMIC PROPERTIES. TABLES FOR ELEMENTS 54 THROUGH 61 IN THE STANDARD ORDER OF ARRANGEMENT

D. D. Wagman, W. H. Evans, V. B. Parker, I. Halow, S. M. Bailey et al Mar. 1971 52 p refs

(NBS-TN-270-5) Avail: SOD $0.55

Thermodynamic tables presented contain values for the standard heats and Gibbs (free) energies of formation, entropies and enthalpies at 298.15 K and heats of formation at 0 K for compounds of vanadium, niobium, tantalum, titanium, zirconium, hafnium, scandium, and yttrium (elements 54-61). Author

N71-24299*# Lockheed Missiles and Space Co., Sunnyvale, Calif.

THERMAL PERFORMANCE OF MULTILAYER INSULATIONS Final Report

C. W. Keller 20 Apr. 1971 104 p refs

(Contract NAS3-12025)

(NASA-CR-72747; LMSC-A974469) Avail: NTIS CSCL 20M

A composite multilayer insulation system composed of double goldized Mylar radiation shields alternated with double silk net spacers was installed on a 4-ft-1(1.22-m-) diameter tank calorimeter and tested in a vacuum environment. Thermal performance tests were conducted for hot boundary temperatures of 500 R (278 K) and 610 R (339 K), and for cold boundary temperatures of 140 R (77 K) and 37 R (20 K). Each combination of these temperatures was imposed with 20, 10, and 5 shield thicknesses of the composite system in place on the tank. Results of these tests were correlated with predictions based on a previously-developed analytical model using measured thicknesses and measured boundary temperatures. The experimental values of heat flux agreed with the analytical predictions within +50 to −30 percent. Author

N71-24300*# Lockheed Missiles and Space Co., Sunnyvale, Calif.

THERMAL PERFORMANCE OF MULTILAYER INSULATIONS Interim Report

G. R. Cunnington, C. W. Keller, and G. A. Bell 20 Apr. 1971 200 p refs

(Contract NAS3-12025)

(NASA-CR-72605; LMSC-A903316) Avail: NTIS CSCL 20M

Analytical and experimental studies were conducted to assess the thermal performance of four multilayer insulations: double-aluminized Mylar/silk net, double-goldized Mylar/silk net, crinkled single-aluminized Mylar, and double-aluminized Mylar/Tissuglas. Heat flux and optical property measurements were obtained for a wide range of variables including number of layers, applied compressive pressures, thickness, and boundary temperatures. A series of equations were developed which characterize the thermal performance of each of the four insulations. All four insulations exhibited reproducibility of heat flux as function of compressive pressure within + or − 20 percent. The silk net and Tissuglas spacer composites exhibited reproducibility of heat flux as a function of layer density within + or − 30 percent, whereas that for the crinkled Mylar system varied up to + or − 80 percent. Comparison of insulation and liquid hydrogen boiloff weights per unit area for a typical design heat flux and a 30-day mission revealed that the Tissuglas spacer system was optimum. Author

N71-24306 Idaho Univ., Moscow.

GAS FILM COOLING PAST A NON-ADIABATIC FLAT PLATE

Gary Leigh Brown (Ph.D. Thesis) 1969 338 p

Avail: Univ. Microfilms: HC $15.30/Microfilm $4.35 Order No. 70-10693

Two theoretical flow models, which represent extremely different viewpoints for the description of film cooling, are developed. These are the discrete film theory, in which the injected coolant is assumed to remain as a discrete film near the downstream surface, and the boundary layer theory, in which the velocity and temperature profiles are assumed to be similar and fully developed within their respective boundary layers. Both theories were used to predict both the adiabatic and non-adiabatic wall temperatures. The boundary layer theory is easy to apply and predicts the effectiveness quite well. Only slight empirical modifications of the results of the theory correlate experimental data, except near the slot, where the boundary layer assumptions are invalid. The discrete film theory relies on the definition of a hypothetical film thickness and is very difficult to apply. Dissert. Abstr.

N71-24318# Cranfield Inst. of Technology (England).

SHOCK TUBE MEASUREMENTS OF THERMAL ACCOMMODATION BETWEEN A HOT GAS AND A COLD SOLID

R. K. Hanson Sep. 1970 47 p refs

(Aero-2) Avail: NTIS

An analysis is presented for the response of a finite thickness, thin film resistance thermometer mounted on the end wall of a shock tube and exposed to a gas suddenly heated by shock wave reflection. It is shown that both the finite thickness of the gauge and gas-solid thermal accommodation effects play a significant role in determining the actual response of such gauges. Shock tube measurements are also presented and combined with the theoretical model to yield the thermal accommodation coefficient for N2 on platinum. The results for the accommodation coefficient are in close agreement and compare favorably with previous measurements at lower pressures using conventional steady state techniques. Author

N71-24328 National Lending Library for Science and Technology, Boston Spa (England).

HEAT TRANSFER THROUGH A BED OF GRANULAR MATERIAL FROM A HOT SURFACE OF A TUBE CONCENTRICALLY MOUNTED IN A ROTARY APPARATUS TO THE WALL OF THE LATTER

D. Ziolkowski et al 7 Jan. 1971 20 p refs Transl. into ENGLISH from Chem. Stosow. (Wroclaw), v. 5, no. 4B, 1968 p 427−444

(NLL-AERE-Trans-1125-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Heat transfer rate through a granular bed in a rotary unit has been investigated. The results are expressed in the form of the effective thermal conductivity. A very characteristic relation between this quantity and the number of revolutions of the unit, as well as the degree of filling of the apparatus with the granular material has been found. For a rather high degree of filling of the apparatus, phi = 0.85, the effective thermal conductivity increases slowly, even in the range of comparatively high numbers of revolutions (n = 60). For lower phi, in the range of phi = 0.40-0.65 the effective thermal conductivity increases initially as the number of revolutions goes up, and after reaching a maximum for a certain value n sub k of the latter, characteristic for given phi, it decreases with the further increase of the number of revolutions. The critical numbers of revolutions n sub k for which the maximum values of the thermal conductivity have been obtained are different for each degree of filling of the apparatus; the lower the phi, the lower n sub k. A dependence of the effective thermal conductivity on the grain size has also been found. Author

N71-24333*# Goodrich (B.F.) Co., Akron, Ohio. Aerospace and Defense Products Div.
LOW COST ABLATIVE HEAT SHIELDS FOR SPACE SHUTTLES Final Report
Herman Freeder and Wilson N. Smith Dec. 1970 112 p
(Contract NAS1-9944)
(NASA-CR-111874) Avail: NTIS CSCL 20M

Two ablative material compositions were used to fabricate two flat and two curved two-foot by four-foot by two-inch thick low density ablative panels. The panels consist of a non-metallic honeycomb reinforcement matrix, bonded to a non-metallic face sheet attachment surface, and filled with ablator material. Several unique techniques and processes were used in the program including hydraulic press and high pressure autoclave cookie cut loading, controlled thickness sequence loading under vacuum bag-atmospheric pressure by use of a flexible barrier curtain, and high pressure autoclave final loading and curing to net panel size. Cost estimates are included for production lots of 1, 10 and 100 panels in various shapes and sizes. Author

N71-24340# Montana State Univ., Bozeman.
NATURAL CONVECTIVE HEAT TRANSFER BETWEEN CONCENTRIC SPHERES Annual Progress Report
J. A. Scanlan and E. H. Bishop Jan. 1971 15 p refs
(Contract AT(45-1)-2214)
(RLO-2214-1) Avail: NTIS

Major results for the heat transfer apparatus included heat transfer and temperature profiles for water and two silicone oils. These data combined with the previously available air data yielded Prandtl numbers from 0.7 to 4148. The utilization of spheres yielding diameter ratios ranging from 1.09 to 2.81 enabled Rayleigh numbers, based on gap width, in the range of 1.3 × 1,000 to 5.8 × 10 to the 8th power to be obtained. It was found that the heat transfer results, both for each fluid individually and for all the data combined, could be correlated simply in terms of the ratio of the effective thermal conductivity to the actual thermal conductivity and a Rayleigh number. A second apparatus, for visual observation of the flow patterns between the spheres and for photographically recording these flow patterns, was constructed and placed in operation. The first fluid to be studied in the gap between the spheres was air, but the apparatus has the capability for using other cooling fluids. Author

N71-24349# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE SUPERCRITICAL REGIME IN DIATHERMAL HEAT EXCHANGERS
Yu. P. Yakovlev 4 Nov. 1970 12 p refs Transl. into ENGLISH from Aviats. Inst., Tr. (Kazan), no. 98, 1968 p 99–106
(AD-718287; FTD-HT-23-455-70) Avail: NTIS CSCL 13/1

New highly effective heat exchangers are needed in aviation, rocket, and nuclear engineering. In ordinary heat-exchanging systems the transfer of heat from one carrier to another through the walls of the heat exchanger is accompanied by both convection and radiation heat exchange. Consequently, the heat is absorbed by the fluid on the opposite side of the wall. An increase in this situation results in critical thermal densities. Underheating helps but cannot always be successful. Supercritical heat exchangers appear to be more efficient. Such devices are obtained by changing the metallic working elements of the heat exchangers for diathermal ones made of pyroceramic, quartz, or other diathermic materials. The result is that the crisis point moves further to the right the later it sets in. The device uses Plancks and Wiens laws. Author (GRA)

N71-24380# Texas A&M Univ., College Station. Dept. of Mechanical Engineering.
ANALYTIC SOLUTION OF THE NONLINEAR HEAT CONDUCTION EQUATION
Antonio Compo and Howard S. Wolko Jul. 1970 28 p refs
(Grant AF-AFOSR-1751-69)
(AD-717868; AFOSR-70-1992TR; TR-1) Avail: NTIS CSCL 20/13

Analytic solution of the nonlinear heat conduction equation is presented. The solution technique is applicable to thermally anisotropic and isotropic media with temperature dependent thermal properties. It is shown that the nonlinear equations can be converted to linear equations with the aid of an algebraic transformation. The algebraic transformation is used to determine the temperature field and the heat transfer in two dimensional isotropic and anisotropic media. Author (GRA)

34 GENERAL

Includes information of a broad nature related in industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents.

N71-23229*# IIT Research Inst., Chicago, Ill.
TECHNOLOGY APPLICATIONS TEAM Final Report, 15 Jun. 1969–14 Jun. 1970
F. Robert Hand Feb. 1971 55 p refs
(Contract NASw-1953; IITRI Proj. V6102)
(NASA-CR-117890) Avail: NTIS CSCL 05K

The development of the experimental procedures for accomplishing technology transfer, the results obtained in applying these techniques, and the significant learnings obtained are described. Author

N71-23251*# State Univ. of New York at Buffalo.
FEDERAL PROCUREMENT: A STUDY OF SOME PERTINENT PROPERTIES, POLICIES AND PRACTICES OF A GROUP OF BUSINESS ORGANIZATIONS Final Report
Raymond G. Hunt, Ira S. Rubin, and Franklyn A. Perry, Jr. Jul. 1970 118 p refs
(Grant NGR-33-015-061)
(NASA-CR-117899) Avail: NTIS CSCL 05A

The results are presented of a questionnaire survey of 27 industrial organizations designed to: (1) illuminate selected perceptions, policies and procedures regarding government contracting; (2) describe general business objectives and managerial methods; and (3) yield assessments of how the surveyed firms perceived their present and future business prospects. A measure of special attention was accorded to exploring policies and procedures relating to contractual incentives and their role in program planning and performance. Author

N71-23310*# Scientific Translation Service, Santa Barbara, Calif.
SOCIAL FACTORS IN CONTROLLING THE DEVELOPMENT OF SCIENTIFIC TEAMS [SOTSIALYNE FAKTORY UPRAVLENIIA RAZVITIEM NAUCHNYKH KOLLEKTIVOV]
Yu. V. Poshekhonov Washington NASA Apr. 1971 15 p refs Transl. into ENGLISH from publ. "Naukovedeniye, Prognozirovaniye, Informatika; Vsesoyuznyy Simpozium, 2ogo Materialy Kiev, 6–9 December 1967" Kiev, Naukova Dumka, 1970 p 166-175
(Contract NASw-2035)
(NASA-TT-F-13552) Avail: NTIS CSCL 05K

An experimental sociological investigation was made of labor organization and control structure in scientific research institutes that deal with the solution of current and expected practical problems for different branches of industry. These scientific teams are concerned with tasks that are intermediate between theoretical research at universities and production and manufacturing in plants. A survey covering a total of 640 persons was made in five institutes working for different branches of industry. The correspondents consisted of 148 management personnel, 156 senior scientists, 97 junior scientists, 189 engi-

neers, and 70 designers. The goal of the survey was to study the social aspects of labor organization and management. The results are discussed in terms of the correspondence between the assigned tasks and the percentage of allotted time actually spent by various personnel in performing these tasks. Author

N71-23333# Catholic Univ. of America, Washington, D.C.
A POSITION PAPER ON VEHICLE SAFETY
Nicholas Perrone Sep. 1970 53 p refs
(AD-718397) Avail: NTIS CSCL 13/12

The problem of the air bag and its development standards and their significance is addressed. The auto safety standards are critically reviewed in detail especially those portions concerned with crashworthiness. Suggestions for specific new additions as well as modifications of existing standards are made. Special attention is focused on the instrument panel area, hard internal spots such as door posts, windshield headers, and main frame structural elements, and the front seat (which should be appreciably strengthened). The worth from a cost/benefit viewpoint of increasing vehicle safety is examined in some detail. The problem of general aviation crashworthiness is also examined in the same context and it is suggested there that immediate retrofitting of existing airplanes should take place in a manner comparable to automobiles (in other terms, similar standards should be invoked). The general question of resource allocation is also examined and it is suggested that greater and organized national attention be devoted to this critical problem. Author (GRA)

N71-23501# Advisory Group for Aerospace Research and Development, Paris (France).
SCIENTIFIC AND TECHNICAL INFORMATION: WHY, WHICH, WHERE, AND HOW? Lecture Series
Feb. 1971 65 p refs Conf. Presented in Oslo, 2–3 Nov. 1970; sponsored by the Tech. Inform. Panel and the Consultant and Exchange Programme of AGARD. Also Presented in Rome, 5–6 Nov. 1970
(AGARD-LS-44) Avail: NTIS

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6. CONCEPT, MISSION, AND OPERATION OF SCIENTIFIC AND TECHNICAL INFORMATION ANALYSIS CENTERS G. S. Simpson, Jr. and J. W. Murdock (Battelle Mem. Inst., Columbus, Ohio) 14 p (See N71-23507 12-34)

N71-23502# National Aerospace Lab., Amsterdam (Netherlands).
INTRODUCTORY PAPER
H. A. Stolk *In* AGARD Sci. and Tech. Inform Feb. 1971 3 p refs (See N71-23501 12-34)
Avail: NTIS

Information systems, and their histories, are briefly discussed along with subjects to be covered in the current lecture series. In this series the product considered was the technological information that exists in the form of printed words, graphs, tables, pictures, specifications, etc., and means by which this information can be transferred. Also discussed in the introductory speech is the transfer of technology and its management. A.L.

N71-23503# Defence Scientific Information Service, Ottawa (Ontario).
WHAT CAN INFORMATION DO FOR YOU ?
Alice M. Ironside *In* AGARD Sci. and Tech. Inform. Feb. 1971 7 p refs (See N71-23501 12-34)
Avail: NTIS

A philosophical, non-technical approach is used to demonstrate that information is both an inherent part of life and a part of the fabric of living, and that information is being presented to the individual continuously throughout his life, by his own senses, by other people, and by the various media of communication. Also, that this information may be unheeded or heeded, and stored in his memory, or may be stored in suitable forms by mechanical, electronic, and other means. Once stored, it may be later retrieved and applied to any appropriate purpose. Information is increasingly being recognized as a prime resource, and the problems of maintaining the store of this resource and of its exploitation are being recognized and solutions sought. Author

N71-23504*# National Aeronautics and Space Administration, Washington, D.C.
USER NEEDS
John F. Stearns *In* AGARD Sci. and Tech. Inform. Feb. 1971 6 p (See N71-23501 12-34)
(NASA-TM-X-67142) Avail: NTIS CSCL 05B

The question of user needs is examined from three viewpoints: what has been and is being done to determine actual user needs; the kinds of services now evolving to satisfy these needs; and possible further steps to improve both definition and satisfaction of these needs. Attention is given to general areas of bibliographic services, and to specific opportunities inherent in these services for the application of techniques and procedures that may provide potential users with easier access to a wider range of informational alternatives. Author

N71-23505# National Aerospace Lab., Amsterdam (Netherlands).
SOURCES OF SCIENTIFIC AND TECHNOLOGICAL INFORMATION
H. A. Stolk *In* AGARD Sci. and Tech. Inform Feb. 1971 13 p refs (See N71-23501 12-34)
Avail: NTIS

Attention is paid to the information environment, the information explosion, and the user and his behavior. Informal channels and formal services for obtaining information are discussed. A short description is also given of the problems in information retrieval. Author

N71-23507# Battelle Memorial Inst., Columbus, Ohio.
CONCEPT, MISSION, AND OPERATION OF SCIENTIFIC AND TECHNICAL INFORMATION ANALYSIS CENTERS
G. S. Simpson, Jr. and J. W. Murdock *In* AGARD Sci. and Tech. Inform. Feb. 1971 14 p (See N71-23501 12-34)
Avail: NTIS

Information Analysis Centers (IAC's) are discussed in three parts: concept, mission, and operation. Since there is an array of existing scientific and technical information services varying from the conventional library, through special libraries and document depots to IAC's, the presentation considers what an IAC is, how it relates to other information services, and its fundamental concept. The mission of an IAC is considered in the light of its users, or peer group, how unpublished information is obtained and used, and how feedback helps the IAC achieve its mission. Two non-government supported IAC are described along with one government center. Also considered are operational aspects (administration and management) of an IAC. Based on close contact

with over a dozen operating IAC's, actual experiences pertaining to the recruitment and utilization of competent research scientists and engineers in information analysis work, advantages of working in an IAC environment, key problems in day-to-day operation, and the ever present problem of money are discussed. Author

N71-23511*# National Aeronautics and Space Administration, Washington, D. C.
THE USE OF A SPACE STATION TO ADVANCE THE GOALS OF SCIENCE
Henry J. Smith 1970 24 p Presented at the NASA Briefing on Space Sta. Plans and Programs, Paris, 3–5 Jun. 1970; sponsored by ESRO
(NASA-TM-X-67136) Avail: NTIS CSCL 22A

NASA programs for the next decades when the space stations will be available are reviewed. The three fields of investigation are: (1) bioscience including effects of space environments on terrestrial organisms, biological effects of weightlessness and radiation, the role of gravity in biological processes, the origin and nature of biological rhythms; (2) astronomy including transient solar phenomena and active solar events using Apollo Telescope Mount (ATM); and (3) physics, including plasma wake investigation, O/B plasma laboratory research, studies of environmental perturbations, and high cosmic ray laboratory. ESRO

N71-23634# Mettler Instrument Corp., Princeton, N.J.
REPORT ON THE 1968–1969 MASS MEASUREMENT AGREEMENT COMPARISON ROUND ROBIN
Lloyd B. Macurdy *In* NBS Innovative Metrology: Key to Progr. Mar. 1971 p 41–46 (See N71-23626 12-14)
Avail: SOD $1.50

Seventeen laboratories took part in the round robin measurements of the mass comparison packages during 1968 and 1969. In order to speed up the measurements the laboratories were divided into two groups. The weights were calibrated by the NBS Mass Laboratory at the beginning and again at the end, and Mettler Instrument Corporation measured all sets near the middle of the series. Two sets of weights were sent to each laboratory at times separated by two months or more in order to provide data on errors made on the same day (within-group variance) and on errors between measurements at longer intervals (between-group variance). Each set of weights consisted of four pairs of one-piece stainless steel weights of 100 g, 25 g, 10 g, and 1 g. Date include weighing errors of the various laboratories and Youden plots of the measurements. Some errors proved to be larger than expected. The results illustrate the need for verifying the accuracy of measurement on some rotational basis. Author

N71-23635# Martin Marietta Corp., Orlando, Fla.
NCSL SPECIFICATION PRESENTATION
Frank J. Dyce *In* NBS Innovative Metrology: Key to Progr. Mar. 1971 p 47–50 (See N71-23626 12-14)
Avail: SOD $1.50

The specification contains the minimum essential requirements of a calibration system. The steps required to approve the specification as a recommended practice and to obtain Government approval and adoption are discussed. Author

N71-23636# Westinghouse Electric Corp., Baltimore, Md. Defense and Space Center.
COST VISIBILITY EXCHANGE PROGRAM: A NEW APPROACH TO COOPERATIVE SAVINGS
R. J. Barra *In* NBS Innovative Metrology: Key to Progr. Mar. 1971 p 51–56 (See N71-23626 12-14)
Avail: SOD $1.50

A preliminary survey by the Calibration Systems Management Committee indicates 600,000 manhours per year spent on 9 types of instruments, including oscilloscopes. Member organizations are asked to contribute cost data with the objective of saving one million dollars in calibration and maintenance costs by 1972. Author

N71-23641# National Bureau of Standards, Washington, D.C.
BREAKTHROUGH TECHNIQUES FOR METROLOGY WORK
Lloyd B. Wilson *In its* Innovative Metrology: Key to Progr. Mar. 1971 p 85–88 refs (See N71-23626 12-14)
Avail: $1.50

Metrology work involves the conflicting and diametrically opposed problems of control versus breakthrough. Controls are vital to assure accuracy and reliability. However, breakthroughs are necessary to provide improved accuracies, ranges, and types of measurements. The dichotomy of this situation comes principally from the differences in attitudes involved. Ideally, control and breakthrough should be carried out by two different types of people because of these differences. Breakthrough techniques coupled with proper attitudes and a systematic method for establishing objectives and evaluating alternatives, provide a powerful set of new tools for improvement. Examples are given showing the possibilities for applying these tools to reduce cost and provide needed measurement and calibration services. Author

N71-23642# National Bureau of Standards, Washington, D.C. Office of Weights and Measures.
THE NEW STATE STANDARDS PROGRAM
Robert Mills *In its* Innovative Metrology: Key to Progr. Mar. 1971 p 89–94 refs (See N71-23626 12-14)
Avail: SOD $1.50

In 1965, Congress appropriated funds for new state standards and instruments in mass, length, and volume. The laboratories receiving this package are, in most cases, under the administration of state offices of weights and measures. These labs not only check the accuracy of field standards used by weights and measures inspectors, but also serve as local measurement centers to perform industrial tests. The equipment and training given to laboratory personnel are described as well as some of the administrative details and the utilization for the state laboratories. Author

N71-23643# General Dynamics/Convair, San Diego, Calif. Standards and Calibration Labs.
THE IMPORTANCE OF VISIBILITY AND CONTROL IN LABORATORY MANAGEMENT SYSTEMS
John L. King *In* NBS Innovative Metrology: Key to Progr. Mar. 1971 p 95–98 (See N71-23626 12-14)
Avail: SOD $1.50

A computerized test equipment control system and the responsibilities of the engineering section in charge of the control system are described. The computerized system has inputs of all parameters of test equipment cost, control, and life-history, and the outputs contain all information required for intelligent decision-rule formulation or equipment control. The system permits a close view of models in use, preferred, and in storage status. The problem of calibrating intervals is also discussed, and the test equipment is divided into critical and regular application categories. N.E.N.

N71-23645# Aerospace Guidance and Metrology Center, Newark Air Force Station, Ohio. Metrology Engineering Div.
NEW US AIR FORCE AUDIT PROGRAM
Lloyd W. Root *In* NBS Innovative Metrology: Key to Progr. Mar. 1971 p 105–110 (See N71-23626 12-14)
Avail: SOD $1.50

A quality assurance audit program used for testing worldwide Precision Measurement Equipment Laboratories (PMEL's) is described. Conventional methods utilized during previous audits are examined briefly and disadvantages noted. The advent of highly sophisticated systems and test equipment has placed increased

emphasis on the experience and skill level of the technicians who provide calibration support at PMEL's. Specific configuration of a unique package designed to evaluate this skill level is discussed in some detail and results obtained during the past year are presented. Author

N71-23650# Electrotechnical Lab., Tokyo (Japan). Standards Div.

PRESENT STATUS OF ELECTRICAL STANDARDS AND THEIR TRACEABILITY IN JAPAN

M. Kanno *In* NBS Innovative Metrology: Key to Progr. Mar. 1971 p 129–132 (See N71-23626 12-14)

Avail: SOD $1.50

The national electrical standards of Japan, dissemination of the standards, and the traceability and measuring techniques are described. Author

N71-23741*# National Aeronautics and Space Administration. Washington, D.C.

REMARKS OF JAMES E. DENNY BEFORE THE STUDY GROUP ON LEGAL REMEDIES, COMMISSION ON GOVERNMENT PROCUREMENT

James E. Denny [1971] 22 p refs Conf. held at Washington, D.C., 17 Feb. 1971

(NASA-TM-X-67143) Avail: NTIS CSCL 05A

Comments concerning the legalities of patent infringements resulting from current government procurement policies are reported with some suggested remedies for providing protection of the patent rights. It is recommended that each government agency have full authority to administratively settle claims of patent infringement before suit is brought against the government, and each agency should have authority for permitting the patent owner to proceed directly against the infringing contractor. F.O.S.

N71-23742*# National Aeronautics and Space Administration, Washington, D.C.

US-SOVIET AGREEMENT

31 Mar. 1971 20 p ref

(NASA-News-Release-71-57) Avail: NASA Scientific and Technical Information Facility, P.O. Box 33, College Park, Md. 20740 CSCL 05D

The agreement between the National Aeronautics and Space Administration and the Academy of Sciences of the USSR is presented. The agreement provides for initiating an exchange of lunar samples obtained by the two countries and establishes procedures to produce recommendations for joint consideration of the objectives and results of space research, the improvement of existing weather data exchanges, research with meteorological rockets, techniques for studying the natural environment, and the expanded exchange of data on space biology and medicine. Author

N71-24060*# American Inst. of Astronautics and Aeronautics, Los Angeles, Calif.

TECHNOLOGY AND THE PUBLIC SECTOR

Victor Magistrale Jul. 1970 88 p

(NASA Order H-800D6A)

(NASA-CR-61344) Avail: NTIS CSCL 05B

The impact of technology on social problems is a matter of increasing concern to the general public as well as the scientific, engineering, and educational communities. A study is presented on the complex nature of interfaces which exist among technologists, public administrators, and people in need of improved systems and services. Author

N71-24072*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

DESIGN OF A DOCUMENT RETRIEVAL SYSTEM USING PATTERN RECOGNITION AND MATHEMATICAL PROGRAMMING TECHNIQUES

Steven R. Borbash, Jr. (Ph.D. Thesis–Pittsburgh Univ.) 1970 286 p refs

(NASA-TM-X-67164) Avail: NTIS CSCL 05B

The design and testing of a document retrieval system (DRS) using the NASA Scientific and Technical Information System is discussed. The analytical model used for the DRS treats the system as a pattern recognizer. The objective of the system is to automatically develop a set of Boolean file searching instructions from a sample of relevant and non-relevant documents. A computerized file of document numbers and associated index terms is assumed to be available. The system presented here receives as input a sample set of documents from this file. Each of the documents in the set has been assigned a personal utility by a user. In addition to the sample set, the user has specified a utility threshold which defines two categories, relevant and not relevant. The system output is a set of searching instructions for retrieving all other documents from the file which are predicted to be relevant, based on the examples provided in the sample set. The searching instructions are presented as Boolean combinations of index terms which are collectively known as a Boolean retrieval strategy (BRS). Author

N71-24080*# Auburn Univ., Ala. School of Engineering.

THE IMPLICATIONS OF THE SATURN 5 SYSTEMS APPROACH TO EDUCATION AND OTHER PROGRAMS

Malcolm A. Cutchins Jun. 1970 73 p refs Sponsored by NASA

(NASA-CR-61347) Avail: NTIS CSCL 06N

A retrospective view is presented of the systems approach as applied by people of the Marshall Space Flight Center to produce the Saturn launch vehicles. A critical analysis is made of the management attitudes and philosophies of key people involved in that effort based on several dozen recorded interviews. Desirable and undesirable human tendencies that work for and against success with the systems approach, as identified by those interviewed, are classified and summarized. Author

N71-24082*# National Aeronautics and Space Administration, Washington, D.C.

COLOMBO IN NEW YORK TODAY FOR DISCUSSIONS WITH U THANT [COLOMBO OGGI A NEW YORK PER IL COLLOQUIO CON U THANT]

M. de Medici Mar. 1971 4 p Transl. into ENGLISH from Il Tempo (Italy), 22 Feb. 1971 p 2

(NASA-TT-F-13586) Avail: NTIS CSCL 05D

The visit of Premier Colombo in the U.S. is described along with the indoctrination given him by NASA officials, concerning the post-Apollo program. D.L.G.

N71-24106# Ballistic Research Labs., Aberdeen Proving Ground, Md.

INFORMATION AND ITS RETRIEVAL

Ceslovas Masaitis Nov. 1970 55 p refs

(AD-718032; BRL-1513) Avail: NTIS CSCL 5/2

Information is defined abstractly as a set of highly structured elements. This structure induces a two-way classification of the elements and also other relations among them. The definition includes rules for expanding this information by incorporating new elements and for discarding elements that have become obsolete or are no longer needed. The definition of information is geared to its purpose, viz. to provide easy retrieval of known facts that are of interest to a specialist in the field. A pilot example of such a retrieval system is included, and principles for the physical realization of the system are presented. It is stated that a clear distinction must be made between a collection of documents and the information they contain. Likewise, the difference between recovering relevant documents and retrieving desired information is emphasized. Author (GRA)

N71-24107# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
SAFETY HAZARDS
8 Dec. 1970 6 p refs
(AD-718783; MTP-5-3-510) Avail: NTIS CSCL 16/4

The Common Service Test Procedure describes safety inspections and operational evaluations for missile and rocket equipment and anti-aircraft guns during service tests. However, the inspections and evaluations may be adapted for safety testing of other items of equipment. The primary objective is to isolate, identify and alleviate hazardous conditions associated with electrical, chemical and radiated energies, as well as noise and fumes and exhausts. Author (GRA)

N71-24108# RAND Corp., Santa Monica, Calif.
AEROSPACE PRICE INDEXES. PROJECT RAND
H. G. Campbell Dec. 1970 36 p refs
(Contract F44620-67-C-0045)
(AD-718089; R-568-PR) Avail: NTIS CSCL 5/3

An analysis of publications prepared by the Bureau of Labor Statistics relating to price indexes leads to a criticism of the sufficiency of data on aerospace items, with the exception of hourly earnings information. Overhead is an important cost component of major purchased materials and finished production items, but it has not been treated in any regularly published report. Thus any index purporting to measure price changes in aerospace products may be questioned. Simple and convenient indexes, including those presented here, are no substitute for reasonably thorough analysis and should be used only if such analysis cannot be accomplished. GRA

N71-24203 Purdue Univ., Lafayette, Ind.
ON PRINCIPLES OF TECHNICAL DIRECTION FOR ASTRONAUTICAL RESEARCH AND DEVELOPMENT PROJECTS OF HIGH NATIONAL PRIORITY
Thomas Cardwell Brown, Jr. (Ph.D. Thesis) 1969 77 p
Avail: Univ. Microfilms: HC $34.70/Microfilm $9.75 Order No. 70-8866

The concepts used by the Federal Systems program office to formulate the technical direction strategy for urgent astronautical projects of high national priority were explored. A version of the principles of war was used as an exploratory set to search for dominant concepts in sixty interviews with program directors and key executives in DOD (Army, Navy, Air Force), AEC, NASA, and three contractors (Aerospace Corporation, Bell Telephone Laboratories, and Thompson-Ramo Wooldridge Systems Laboratories). The interview data was the inductive source for candidate concepts. The resulting concepts were developed and modified by the relevant literature and when appropriate confirmed in four different sets of system program offices. Dissert. Abstr.

N71-24204*# Stanford Univ., Calif. Inst. for Plasma Research.
SCIENCE AND THE WEIGHING OF EVIDENCE
P. A. Sturrock Mar. 1971 24 p refs
(Grant NGL-05-020-272; Contracts F44620-69-C-0008; N00014-67-A-0112-0006)
(NASA-CR-118004; SU-IPR-413) Avail: NTIS CSCL 05B

Progress in science depends on the appraisal of hypotheses by reference to observational data. This procedure has been formalized in such a way that judgments made by theorists and judgments made by observers may be combined to yield probabilities for the considered hypotheses. Author

N71-24205*# National Aeronautics and Space Administration, Washington, D.C.
GRAPHIC ARTS TECHNIQUES AND EQUIPMENT: A COMPILATION
1970 23 p
(NASA-SP-5919(01)) Avail: NTIS CSCL 05B

A compilation of summary descriptions of a variety of graphic arts techniques and equipment are presented. It is felt that these techniques and devices will aid their users in faster production at no sacrifice in quality and, in some instances, noticeable improvement in product quality. No claim is made for novelty in these techniques and devices, but all are believed useful and practical. Author

N71-24270 National Lending Library for Science and Technology, Boston Spa (England).
THE STATE ROLE IN INFORMATION: NATIONALLY AND INTERNATIONALLY
Bjorn Tell 16 Feb. 1971 12 p Transl. into ENGLISH from Tidskr. Dok. (Sweden), v. 4, no. 24, 1968 p 52–56 Presented at the Ann. Meeting of the TLS, Falun, Sweden, 27 May 1968
(NLL-M-20329-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The problems of processing and disseminating the flood of scientific and technical information within a country and among OECD countries are discussed. Documentation reproduction, communication techniques, personnel training, and costs are described, and the need for each country to make decisions regarding new techniques is stressed. The Eastern European organization COMECON, corresponding to OECD, is also reviewed. N.E.N.

N71-24307# Committee on Science and Astronautics (U.S. House).
AUTHORIZING APPROPRIATIONS TO THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION Report, Together With Additional and Separate Views, To Accompany H.R. 7109
Miller Washington GPO 1971 176 p refs Presented to the Comm. of the Whole House on the State of the Union, 92d Congr., 1st Sess., 22 Apr. 1971
(Rept-92-143) Avail: US Capitol, House Document Room

Recommendations from the House of Representatives subcommittee authorizing appropriations to the National Aeronautics and Space Administration for fiscal year 1972 are reported. Programs outlined include: research and development, construction of facilities, and research and program management. E.M.C.

N71-24327*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PUBLICATIONS OF THE JET PROPULSION LABORATORY, JULY 1969–JUNE 1970
1 May 1971 294 p refs
(Contract NAS7-100)
(NASA-CR-108731; JPL-Bibl-39-11) Avail: NTIS CSCL 05B

The JPL bibliography which describes and indexes the formalized technical reporting, released July 1969 through June 1970, that resulted from scientific and engineering work performed, or managed, by the Jet Propulsion Laboratory is presented. Four classes of publications are included: (1) Technical reports: in which the information is complete for a specific accomplishment and is intended for a wide audience. Technical reports are either new reports or reprints of certain articles published in the open literature. (2) Technical memorandums in which the information is complete for a specific accomplishment but is intended for a limited audience to satisfy unique requirements. (3) Articles from three volumes of the Space Programs Summary. Each volume's collection of articles presents a periodical survey of current accomplishments in the subject area covered by that volume. (4) Open literature articles that

were not selected for reprint release as technical reports. The publications are indexed by: (1) author, (2) publication type and number, and (3) subject. A descriptive entry appears under the name of each author of each publication; an abstract is included with the entry for the primary (first-listed) author. Unless designated otherwise, all publications listed are unclassified. Author

N71-24332*# National Aeronautics and Space Administration, Washington, D.C.
NASA SPECIAL PUBLICATIONS: A SELECTIVE CATALOG, SPRING 1971
1971 48 p refs
(NASA-TM-X-67162) Avail: SOD $0.30; NTIS CSCL 05B

A catalog of NASA special publications is presented. Included are abstracts of documents on Mariner and Apollo flights, technology utilization, and bioinstrumentation. F.O.S.

PUBLIC COLLECTIONS OF NASA DOCUMENTS

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NASA deposits its technical documents and bibliographic tools in eleven Federal Regional Technical Report Centers located in the organizations listed below. Each center is prepared to furnish the public such services as reference assistance, interlibrary loans, photocopy service, and assistance in obtaining copies of NASA documents for retention.

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An extensive collection of NASA and NASA-sponsored documents and aerospace publications available to the public for reference purposes is maintained by the American Institute of Aeronautics and Astronautics, Technical Information Service, 750 Third Avenue, New York, New York, 10017.

EUROPEAN

An extensive collection of NASA and NASA-sponsored publications is maintained by the National Lending Library for Science and Technology, Boston Spa, Yorkshire, England. By virtue of arrangements other than with NASA, the National Lending Library also has available many of the non-NASA publications cited in *STAR*. European requesters may purchase facsimile copy or microfiche of NASA and NASA-sponsored documents, those identified by both the symbols "#" and "*", from: ESRO/ELDO Space Documentation Service, European Space Research Organization, 114, av de Neuilly, 92-Neuilly-sur-Seine, France.

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NEW NASA PUBLICATIONS

Fracture Control of Metallic Pressure Vessels (NASA SP–8040)

A new space vehicle design criteria publication in the series on structures. This monograph presents NASA's present criteria and recommended practices to aid in the design of metallic pressure vessels (such as high-pressure gas bottles, solid-propellant motor cases, and storable and cryogenic liquid-propellant tanks) by minimizing the occurrence of proof-test failures resulting from cracks and assuring against preflight and flight failures. *Paperbound.* 64 pp. Available from the National Technical Information Service, Springfield, Va. 22151, for $3.00.

Acoustics Technology (NASA SP–5093)

By SKIPWITH W. ATHEY

Problems of acoustics and the control of noise have demanded increasing attention. NASA has sponsored extensive investigations in this area of technology as it pertains to the aerospace field. This survey contains a comprehensive list of references which have been carefully selected after an intensive search of the available literature. It includes discussions of the mechanisms of noise generation, the origin and propagation of noise, and the effects on structures and people. The author has related these subjects to nonaerospace applications, and has emphasized areas in which the technology can be used to solve the problems generated by an ever-increasing pollution of noise in the atmosphere. This document should be a valuable tool for readers involved in all aspects of acoustics and the control of noise. *Paperbound.* 148 pp. Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, for 65 cents.

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